

Chemsol, Inc. Superfund Site

Appendix - A

Transcript of the August 27, 1997 Public Meeting

1
2 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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4 PUBLIC MEETING
5 FOR THE PROPOSED PLAN FOR FINAL CLEANUP
6 AT THE CHEMSOL, INC. SUPERFUND SITE IN :
7 PISCATAWAY, NEW JERSEY
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9
10 Municipal Building
11 455 Hoes Lane
12 Piscataway, New Jersey

13 August 27, 1997
14 7:15: o'clock p.m.

15
16 B e f o r e:

17 PAT SEPPI,
18 Community Relations Coordinator

19 NIGEL ROBINSON,
20 Project Manager

21 LISA JACKSON,
22 Chief of Central New Jersey Superfund
23 Section.

24 JIM HACKLER,
25 Previous Project Manager

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P R O C E E D I N G S

MS. SEPPI: I would like to thank everybody for coming out tonight to this public meeting for the Proposed Plan for Final Cleanup at the Chemsol Superfund Site in Piscataway, New Jersey.

I am Pat Seppi, Community Relations Coordinator with the EPA, Region 2, in New York City. I would like to introduce the people that will be giving short presentations tonight.

Nigel Robinson is EPA Project Manager for the Chemsol site.

Jim Hackler is the old project manager for the Chemsol site and we have asked him to come tonight and Lisa Jackson is the Chief of the Central New Jersey Superfund Section.

Also Paul Harvey from the NJ Department of Environmental Protection is here and also Meyhear Billimoria is here and if anybody has questions for them they will be happy to answer them,

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2 I am sure.

3 If you did not already, please
4 sign in. That is the way we make sure
5 you are on our mailing list for updates
6 or documents that we may want to send
7 out to you. The reason we are here is
8 to present EPA's proposed plan. We have
9 done a lot of studies, a lot of
10 investigations and this is our plan that
11 addresses the best way we found to clean
12 up the contaminated soil and water.

13 Nigel will go into more detail
14 about the other alternatives we have
15 looked at during the presentation. It
16 is important to us that the public is
17 well aware and understand what it is we
18 are trying to do. That is why we have
19 the public meeting and 30-day public
20 comment period.

21 Most of you probably received a
22 copy of the proposed plan in the mail.
23 If you did not there are copies in the
24 back and copies of the fact sheet that
25 went out with the proposed plan. The

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2 public comment period started August
3 11th and extends until September 10th.
4 That is our typical 30-day public
5 comment period. If you have any written
6 comments after you leave here tonight or
7 know anybody who has a comment please
8 have them send it to Nigel so that it is
9 in the proposed plan.

10 You will notice we have a court
11 stenographer. The transcript from this
12 meeting along with any other comments we
13 receive in the mail will be part of the
14 permanent record and will be addressed
15 in what is called a responsiveness
16 summary, which is attached to our final
17 decision document, which is called the
18 Record of Decision.

19 Lisa will explain a little bit
20 more about that when she talks about the
21 Superfund proposals. One of the other
22 thing I wanted to mention was we have
23 received from the public a request to
24 extend the comment period an extra 30
25 days and we have granted that request.

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2 Instead of the comment period being over
3 on September 10th it will be over at the
4 close of business on October 11th.

5 We usually do that if someone
6 requests an extension. We try to
7 accommodate them as much as possible.
8 As I mentioned before there are a lot of
9 documents that relate to Chemsol. You
10 will find the documents in the
11 repository that is right down the street
12 in the library. You are certainly
13 welcome to go look at those at any time.

14 We have tried to leave the bulk
15 of the time for you for your questions
16 and answers. As soon as we are finished
17 we will open the floor for questions and
18 answers. The Mayor of Piscataway is
19 here. Camille Fernicola is here;
20 Assemblyman Bob Smith, who has been very
21 interested in this site and what is
22 going on; two gentlemen Jim Stewart from
23 Ward 4 and Brian Wahler from Ward 2.

24 I would like to turn this over
25 to Lisa.

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1
2 MS. JACKSON: I will keep this
3 very brief because I assume most of you
4 are somewhat familiar with what the
5 Superfund process is about and I
6 apologize, I think I have the longest
7 overhead and this is the shortest screen
8 I have ever seen.

9 The Superfund is the Federal
10 government program for cleaning up
11 abandoned hazardous waste sites
12 throughout the county and it is a
13 multi-step process. It kind of evolved
14 when the Superfund came to be. The
15 first step in the process is usually
16 what we call site discovery. Someone,
17 some entity phones into EPA a complaint
18 about a site, which usually starts a
19 whole gamut of investigatory activities
20 to determine what the status of the site
21 is.

22 As you might guess, most sites
23 are found to be no problem or someone is
24 addressing them or the contamination is
25 not severe enough to warrant Federal

1
2 Government attention. There are those
3 sites that are just the opposite. They
4 do require attention and those
5 eventually are ranked numerically and
6 based on the number they are assigned
7 the numbers above 28.5 they are put on
8 the National Priorities List.

9 I am going to go through a few
10 of the words that you will hear about
11 night. Once a site is listed on that
12 list it becomes available for long term
13 response, sometimes by the Federal
14 Government sometimes by the State of New
15 Jersey. Chemsol was put on the
16 Superfund list in 1983.

17 The first thing that usually
18 happens even before it goes on the list,
19 but I was not quite sure where to put
20 this on the slide, someone comes up and
21 starts to look at the site to determine
22 whether or not there is something that
23 should be done quickly to try to
24 mitigate any immediate threat, to stop
25 the contamination from getting worse

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1
2 while we do what has become a pretty
3 long term investigation to look for
4 contamination, the remedial
5 investigations and feasibility studies
6 and at this site we actually did
7 something kind of inventive when Jim was
8 project manager.

9 He did a focused feasibility
10 study to accelerate the response, to
11 make sure we address the problem as
12 quickly as possible.

13 The other thing that goes on
14 during all these processes is what I
15 loosely term enforcement activities.
16 The way the law is written as to how
17 Federal money can be spent to clean up a
18 site, to investigate a site but there is
19 a strong preference and legally we are
20 required to try to get those parties who
21 placed the contamination, who owned the
22 property that is contaminated to do the
23 cleanup.

24 We spend quite a bit of effort
25 and an awful lot of time trying to

1
2 negotiate with what we what call
3 responsible parties, instead of spending
4 tax dollars to do it. At the
5 culmination of all the study phases we
6 issue what is called a Record of
7 Decision. That is actually part of why
8 we are here tonight.

9 The government is legally
10 obligated to take comments on all
11 decisions that it makes for cleanup of a
12 site, other than those emergency type
13 activities, and what we usually try to
14 do is take comment or get public input
15 if it is not a screaming emergency.

16 Part of our process is to put
17 forth to you in the proposed plan our
18 proposal of how we think we should be
19 addressing this next phase of work. The
20 comments can be given tonight orally
21 because they are recorded by the
22 stenographer, or you can write and send
23 them to Nigel at the EPA. Either way
24 they will become part of the official
25 record.

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2 If you think of something after
3 you leave here tonight you still have
4 plenty of time to get it on the record.
5 The EPA will take those comments and at
6 the end of that issue a legal document
7 called a Record of Decision which
8 outlines our final decision for that
9 cleanup.

10 Once that document is issued we
11 go and do more negotiating with the
12 responsible parties to try to get them
13 to implement the work with their money.
14 If not we spend Federal money to
15 implement it. Like Chemsol we also
16 spend quite a bit of time in operating
17 and maintenance. We are pumping water
18 and continually pumping in order to
19 monitor to see if we are seeing
20 decreasing levels of contamination.

21 After this is all completed
22 there is the deletion of a site from the
23 NPL. Way back when it went on the NPL.
24 Depending on the nature of the
25 contamination it can be decades or many,

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1
2 many years before it is finally deleted.

3 I am now going to turn it over
4 to Nigel, who is going to describe the
5 process for the Chemsol site.

6 MR. ROBINSON: Can everybody
7 hear me?

8 Well, as Lisa and Pat said we
9 are here to bring forth our proposed
10 plan for the Chemsol Superfund Site here
11 in Piscataway, New Jersey. Here we have
12 put down two bullets as the purpose of
13 the proposed plan and it is basically to
14 identify EPA's preferred remedial
15 alternative and rationale for its
16 preference.

17 Basically we want to tell you
18 what we have chosen and the reason why
19 we chose it and to encourage the public
20 to review and comment on the
21 alternatives that are presented here in
22 the proposed plan.

23 Before I move along I just want
24 to show everybody here, I think you are
25 probably all aware where the site is,

1
2 but this is the location of the site
3 right at the end of Flemming Street and
4 right across from Stelton Road.

5 This is just a more detailed
6 view of the site and right along here,
7 this is basically the site along here
8 and here right along the railroad. It
9 is divided into two lots. It is
10 approximately 40 acres. The larger lot,
11 Lot 1-A is about 27 acres. Lot 1-B is
12 about 13 acres.

13 The treatment plant, which I
14 will talk a little bit more about as we
15 go along is located right here. Just to
16 give a brief background on the site, the
17 site was previously a solvent recovery
18 and waste reprocessing facility. They
19 basically accepted waste from different
20 generators and different companies and
21 tried to reprocess it and sell it.

22 They operated from the 1950's
23 through 1964. During their period of
24 operation they had a whole series of
25 accidents, explosions and fires. The

1
2 plant was closed down or ceased
3 operation back in 1964. The property
4 was eventually rezoned for residential
5 use in 1978.

6 The current owner of the site is
7 Tang Realty, and as Lisa mentioned
8 earlier the site was placed on the
9 National Priorities List in 1983 and the
10 EPA and the New Jersey DEP has been
11 involved ever since.

12 From 1983 through 1990 the
13 current owner, Tang Realty, under the
14 direction of the New Jersey Department
15 of Environmental Protection undertook
16 groundwater investigation and in 1988
17 and 1990 removal actions were performed
18 at the site and basically what happened
19 was that we had hazardous waste in
20 drums, in lap packs, bottles at the
21 site, so we went there and we undertook
22 a removal action.

23 Okay, after the removal action
24 was completed we initiated what we call
25 remedial investigation and feasibility

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1 study. That was done in 1990. We
2 decided that we would use a two phase
3 approach and we basically broke it up
4 into Phase 1 and Phase 2, and primarily
5 based on the result we realized that the
6 groundwater was severely contaminated
7 with various substances dumped to a
8 depth of about 130 feet.
9

10 We wanted to move quickly so we
11 could evaluate the options for
12 containment of the contaminated
13 groundwater and soil and prevent it from
14 traveling off site.

15 In the second phase we decided
16 that we would undertake it, so we could
17 determine the nature and extent of the
18 contamination at the site. The remedial
19 investigation was completed last year
20 and these are basically the findings for
21 Phase 2.

22 What we found was that the soil
23 and groundwater is contaminated with
24 volatile organics, semi-volatile
25 organics, pesticides, PCB's and metals.

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2 Sediment samples also indicates the
3 presence of volatile organic,
4 semi-volatile organics, pesticides and
5 metals and the surface water indicates
6 low levels of pesticides and organics
7 which appear to be entering from off
8 site.

9 I did not prepare a table here
10 to show the different contaminates that
11 we found, but it is presented in the
12 proposed plan so anybody that is
13 interested can see all the contaminants
14 we found there.

15 We also prepared what we call a
16 risk assessment and the risk assessment
17 is to evaluate the risk posed by
18 whatever contamination we find at the
19 site and so we looked at contamination
20 that was found in the soil, the
21 groundwater, the surface water, the
22 sediment and the air and performed the
23 risk assessment.

24 EPA acceptable cancer risk range
25 is 10 to the minus 4 to 10 to the minus

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2 6. What that means is there is a one in
3 10,000 to one in one million increased
4 chance of developing cancer over a 70
5 year lifetime from exposure at the site.
6 Based on our risk assessment we found
7 unacceptable risk at the site and
8 basically exposure to surface soil was
9 2.2 times 10 to the minus three and
10 exposure to groundwater and that is 2.4
11 times 10 to the minus two.

12 In addition to a cancer risk we
13 also found non-cancer risk and here we
14 have non-cancer effects are assessed
15 using a hazard index, HI. A hazardous
16 index greater than one indicates a
17 potential for non-cancer health risk.
18 Acceptable non-cancer health effects
19 associated are ingestion of surface soil
20 and groundwater by children, adults,
21 site employees and workers.

22 No risk or non-cancer effects
23 associated with subsurface soil,
24 sediment or surface water was found so
25 basically most of the non-cancer risks

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1
2 were associated with soil on the
3 surface, zero to two feet down and they
4 are associated with children and adults
5 and employees or workers at the site.

6 We also did an ecological risk
7 assessment and what that entails is an
8 appraisal of the actual or potential
9 effect of a hazardous waste site on
10 plants and animals. What we found from
11 the ecological risk assessment is that
12 there is a potential risk from surface
13 soil to small mammals and birds.

14 We found a minimal potential
15 risk from sediments but it was not
16 sufficient to warrant disturbance or
17 remediation of the stream bed. What we
18 are saying is the risk was so small
19 there was nothing to warrant digging up
20 the stream and replace it. We found no
21 significant potential for risk from
22 surface water to water column receptors.

23 Here the topic is remedial
24 action objectives. When we are working
25 through the process of deciding what

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1
2 alternatives we will choose we have to
3 have objectives and these are the
4 objectives that we set about achieving.

5 Restoring the soil at the site
6 to levels which would allow for
7 residential, recreational use without
8 restrictions so we want to clean up the
9 site with as little restrictions as
10 possible, so it can be used for
11 residential recreational use such as
12 parks, playgrounds, et cetera.

13 The other objective we had was
14 to augment the existing groundwater
15 system to contain that portion of
16 contaminated groundwater that is
17 unlikely to be technically practical to
18 fully restore. Restore remaining
19 groundwater to State and Federal
20 drinking water standards and whatever
21 contaminated groundwater that is there
22 we want to be able to clean it up so we
23 can restore it to whatever the State
24 drinking water standard is or whatever
25 the Federal government drinking water

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1
2 standard is.

3 We want to remove and treat as
4 much contamination as possible from the
5 fractured bedrock. I didn't touch on
6 much of it, but one of the problems with
7 this site is that after about six feet
8 down you encounter bedrock and it is
9 fractured. There are a lot of cracks in
10 it, so a lot of contamination has seeped
11 through these cracks.

12 So even though we are currently
13 pumping and we are getting contamination
14 out, a lot of it is still locked up in
15 there and it is difficult to get out, so
16 this was one of other objectives that we
17 had. Remove and treat as much
18 contamination as possible from the
19 fractured rocks. The next one was to
20 prevent human exposure to contaminated
21 groundwater.

22 We want to minimize the exposure
23 to whatever degree we can to humans. We
24 want to prevent exposure to surface soil
25 containing PCB's, one part per million

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2 and lead at 400 parts per million.
3 PCB's at one part per million is the
4 Federal cleanup standard for PCB's in
5 residential areas and the lead standard
6 is 400 parts per million.

7 So we want to clean up the site
8 to meet these criterias. We want to
9 eliminate the source of contamination to
10 the groundwater. So if there is any
11 organics, any chemical in the soil
12 currently we want to be able to remove
13 that soil so it will not continue to
14 leach into the groundwater.

15 So basically we had to come up
16 with remedial alternatives. Since we
17 have two media that we have to contend
18 with that are contaminated at the site,
19 we have soil contamination and we have
20 groundwater contamination our aim is to
21 develop different alternatives so we can
22 address the soil contamination and also
23 address the groundwater contamination.

24 This is a short list of some of
25 the alternatives that we looked at that

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1
2 will address the soil contamination.

3 Some of them were eliminated for several
4 different reasons, but this is the final
5 list that we use for our evaluation and
6 for the first alternative, S-1, that is
7 no further action.

8 Under the Superfund law we have
9 to look at no further action, which is
10 basically what would happen if we did
11 nothing at the site and we use that as a
12 bench mark to compare it with the other
13 alternatives that we will choose or look
14 at.

15 The second one was capping the
16 area with soil. Basically that is
17 moving soil in, placing it over the
18 entire site or the areas that are
19 contaminated. Seeding it with grass and
20 by doing that that would eliminate the
21 exposure of contaminants in the surface
22 soil to adults, kids, workers or
23 employees at the site.

24 The third alternative was
25 excavation an off-site disposal. Under

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1
2 that alternative we basically would
3 excavate the contaminated soil and just
4 truck it off to some off-site disposal
5 facility and that would pretty much take
6 care of whatever source of contamination
7 we have in the soil.

8 There is another alternative,
9 S-4A. We would excavate and perform
10 on-site low temperature thermal
11 desorption of PCB contaminated soil.
12 Basically what that is, it is not an
13 incinerator but it is something close
14 and we would excavate the soil, put it
15 in this machinery and provide it with
16 heat.

17 It would remove the PCB's and
18 other organics, some of the other
19 organics from the soil. It would be
20 free of PCB's and organics and the
21 portion of soil that contains lead, what
22 we would do, since we cannot destroy
23 lead we would just have to solidify it
24 and leave it on site, so basically in
25 solidifying it we would end up mixing it

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1
2 with cement and placing it in a certain
3 area on site and once you do that then
4 that minimizes the risk and contact of
5 lead contaminated soil to children,
6 adults, workers and just the environment
7 in general.

8 The other one is basically the
9 same process as the one before it, but
10 instead of solidifying the lead
11 contaminated soil on site we would truck
12 it off to disposal facilities off-site.

13 The groundwater alternatives.
14 As most people here know the groundwater
15 treatment facility has been in operation
16 since, I think, 1994 at the site, and
17 basically what it does is we have a
18 treatment plant and we pump from one
19 well, now I think it is about 25 gallons
20 per minute, and we pass it through a
21 whole host of treatment processes that
22 will remove organics and/or contaminants
23 from the groundwater.

24 We looked at different
25 groundwater alternatives that we could

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1
2 use to augment the current treatment
3 facility there, and as I mentioned
4 earlier we always have to look at the no
5 action alternative. Basically what
6 would happen if we did nothing and just
7 walked away from the site.

8 The next one would be continue
9 existing interim action, extract
10 groundwater from Well C-1 and pass it
11 through these different treatment
12 processes. Under that one we have two
13 options. We looked at two options.
14 Currently we are using Option A, where
15 the treated groundwater is released to
16 the Middlesex County Utilities Authority
17 and also Option B where the treated
18 water is released to Stream 1A.

19 The third alternative for
20 groundwater is basically just an
21 addition to Alternative 2. We currently
22 pump from just one well. What we would
23 do in this alternative is to pump from
24 additional wells, and we are looking at
25 about five additional wells so we would

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1
2 pump here and just pump it right to the
3 current treatment facility and whatever
4 is going on now would continue to go on.
5 Currently we are pumping about 25
6 gallons per minute. Under this
7 alternative it would go up to about 50,
8 55 gallons per minute.

9 We previously looked at soil
10 alternatives and now we have to look at
11 the cost. The cost is always an issue.
12 Whether it is viable or not, too cheap,
13 too expensive and we have different
14 factors that we look at. We look at the
15 capital cost. How much capital would it
16 cost to implement it.

17 We have all of the different
18 alternatives under the soil that I
19 previously mentioned, the no action,
20 capping the soil, excavation, thermal
21 desorption treatment on site. When
22 looking at the costs we have to look at
23 operation and maintenance costs.

24 What that is, currently the
25 facility there that is in operation

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1
2 incurs operation and maintenance costs
3 because the groundwater has to be pumped
4 and it has to be treated. You have to
5 pay for electricity. You have to pay
6 for treatment. You have to pay for
7 maintenance, et cetera.

8 That is also another factor that
9 we have to look at. Here we look at
10 what we call the net present worth.
11 That is how much money would we need to
12 put up front so that over the next 30
13 years we could not meet the projected
14 cost expenses. All of these costs here
15 are based on a 30 year schedule. How
16 much money would we need to put up front
17 now so I could pay for the costs and pay
18 for the operational costs over the next
19 30 years.

20 Then this column, this would be
21 the implementation time. How long would
22 it take to implement the remedy. In
23 this case this is basically once you get
24 the go ahead how long would it take
25 physically on site to do whatever you

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1
2 need to do to the soil and whatever you
3 need to do to the groundwater to get the
4 whole thing running, and so from here we
5 can see this is more in terms of cost.
6 The net present worth is really the
7 column that we need to focus on and we
8 see for the no action it would cost us
9 \$338,000 that being the lowest and the
10 most expensive one would cost us \$12
11 million.

12 We had to do the same cost
13 analysis for the groundwater alternative
14 that we looked at and here we have a
15 capital costs, annual cost, annual
16 operation and maintenance cost and you
17 can see here that it gets pretty high.
18 Under the existing operation that we
19 have at the plant you are looking at
20 almost a half a million dollars a year
21 to operate the plant.

22 Under another option, GW-5 it is
23 close to three-quarters of a million
24 dollars to operate it on an annual basis
25 so this is the important column in that

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1
2 present net present worth, and we see
3 what the costs are and for the no
4 further action that is the cheapest one
5 and it is over \$900,000 and under GW-5,
6 Option B, which would be releasing it to
7 the stream it is a little over \$12
8 million.

9 After we have come up with our
10 list of alternatives, the soil
11 alternatives and the groundwater
12 alternatives we have to go through what
13 we call an evaluation criteria.
14 Basically we have a list of nine
15 criteria that we have to evaluate, and
16 the first one on the list of
17 alternatives that we decide on we have
18 to look at overall protection of human
19 health and environment and determine if
20 this alternative provides us with enough
21 protection for human health in the
22 environment.

23 We also have to look at
24 compliance with ARAR's among other
25 relevant and appropriate requirements.

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1
2 To put it in a nutshell, we have to see
3 if the alternatives comply with other
4 environmental laws. We have to look at
5 the long-term effectiveness of the
6 alternatives.

7 We have to look at whether it
8 reduces the toxicity or mobility or
9 volume of the treatment whether they are
10 in the soil or groundwater. We look at
11 the short-term effectiveness,
12 implementability. How easy is it to
13 implement it. We look at cost and we
14 look at whether the State will accept
15 the alternatives that we choose and
16 whether the community will accept the
17 alternatives we chose.

18 That is one of reasons we are
19 here today, to show you the alternatives
20 that we prefer and see if you are
21 accepting of it and what comments you
22 have on it. So after going through all
23 of that we did an analysis of what we
24 thought was best based on all of those
25 nine criterias that we just went

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1
2 through.

3 The EPA's preferred alternative
4 for the soil portion of the
5 contamination, we preferred the
6 excavation and off-site disposal of the
7 contaminated soils that are currently
8 there at the site and for the
9 groundwater portion, we prefer to
10 extract and treat the groundwater with
11 additional wells using existing
12 treatment technology. So basically the
13 treatment plant is there in operation.
14 What we prefer to do is just to add
15 additional wells, pump from them and
16 pass that water through the treatment
17 facility.

18 The next step in the process,
19 and as Lisa mentioned earlier and
20 briefly described is a Record of
21 Decision and after going through this
22 entire process we have to come up with a
23 Record of Decision. That is what is our
24 decision, what alternatives have we
25 chosen and put it in a document, which

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1
2 is a legal document which is to be
3 implemented at site.

4 So after the proposed plan,
5 after we get the comments from the
6 public we will prepare a Record of
7 Decision and whatever decisions we make
8 will be implemented, and in addition to
9 that Lisa also mentioned that we will do
10 additional groundwater investigation to
11 determine if the contaminated
12 groundwater is leaving the property
13 boundaries.

14 Right now Well C-1 is capturing
15 most of the groundwater at the site, but
16 we still feel that some groundwater
17 could be leaving the site and based on
18 the alternative that we have chosen in
19 adding additional wells, pumping wells
20 at the site we think we will be
21 capturing most of the groundwater at the
22 site and basically capturing everything
23 at the site, but we feel we still need
24 to do additional investigation just to
25 be sure that none is leaving the site or

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1
2 if any, minimal.

3 With that comes the end of my
4 presentation and I will turn you over to
5 Pat Seppi who will act as moderator in
6 taking questions and answers.

7 MS. SEPPI: I know it seems we
8 have thrown you a lot of information,
9 but we have tried to keep it short
10 because found in the past these long
11 full blown explanations sometimes it is
12 better to just let you ask questions and
13 since we do have a court stenographer
14 this is part of the record. We would
15 ask you to come up to the mike to ask
16 your question and state your name first
17 so we will have it for the record, and
18 if you could spell it also.

19 ASSEMBLYMAN SMITH: Actually let
20 me thank the U.S. EPA for a very
21 informative presentation and also for
22 the work you have done so far to clean
23 up the site. Your presentation did
24 generate some questions.

25 No. 1, just prior to the

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2 presentation we had a chance to talk
3 informally and I believe Mr. Hacklar
4 indicated that so far on the site
5 approximately \$10 million has been spent
6 associated with the current clean up.

7 MR. HACKLAR: Roughly.

8 MR. SMITH: You mentioned to me
9 the responsible party has stepped up to
10 the plate and has been acting
11 responsibly.

12 MR. HACKLAR: Tang Realty is one
13 of a group of responsible parties. What
14 has happened is that Tang Reality is one
15 of a group of responsible parties that
16 designed and constructed and is
17 operating and maintaining the treatment
18 system on the site, and that group is
19 really the group that has spent the
20 majority of the money so far.

21 ASSEMBLYMAN SMITH: But they are
22 acting in accord with the Superfund Law.
23 The responsible party is taking
24 responsibility.

25 MR. HACKLAR: That is correct.

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2 ASSEMBLYMAN SMITH: It appears
3 that the alternatives recommended by the
4 EPA for both groundwater and soil are on
5 the order of \$18 million dollars for
6 that clean up that is currently being
7 recommended; is that true.

8 MR. HACKLAR: Is that is
9 correct.

10 ASSEMBLYMAN SMITH: Is there any
11 reason to believe that the responsible
12 parties will not be responsible with
13 regard to that \$18 million.

14 MR. ROBINSON: At this point
15 there is no reason to believe they will
16 not pay. As a matter of fact they are
17 willing and looking forward to
18 negotiating with us for implementing the
19 Record of Decision.

20 ASSEMBLYMAN SMITH: That is
21 certainly also good news. In the
22 background information there is the
23 statement, I believe on Page 2 that
24 there are approximately 180 private
25 wells at residential and commercial

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2 addresses that are potentially active,
3 that means not sealed within a radius of
4 two miles of the site and 22 of these
5 wells are located at a distance less
6 than a half a mile from the site.

7 I guess the obvious question, at
8 least with regard to the 22 wells that
9 are at within a half a mile from the
10 site is, have they been tested for
11 contamination?

12 MR. HACKLAR: Previously,
13 several years ago we did have a sampling
14 event of residential wells in the area.
15 That was probably five years ago.
16 People that wanted their wells sampled
17 approached us and we went out and
18 sampled those wells.

19 While there are wells there
20 sealed there are probably still wells in
21 the area that may in fact not be sealed.
22 It is my understanding that there is
23 municipal water available to people if
24 they want it in the area.

25 ASSEMBLYMAN SMITH: I believe

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2 that is true. We are pretty much a
3 fully -- our infrastructure is pretty
4 much in place in Piscataway. That being
5 said the recommendation to you from me
6 is with respect to those 22 homes or
7 those 22 wells which maybe active that
8 whether the property owner has requested
9 testing or not, I think the testing
10 should be done.

11 We have now had several years
12 elapse. You have been pumping water out
13 of that site for three years.
14 Groundwater is moving and I think with
15 regards to those 22 wells it would
16 provide some piece of mind to the
17 community to know that the contamination
18 is not migrating or the groundwater is
19 not moving off-site and I know of you
20 have your consultant here and
21 hydrogeologists have looked at this
22 thing and the technical people, that
23 being said it would be nice to know with
24 regard to those 22 wells that we know
25 for a fact by means of current testing

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1
2 that the contamination has not moved and
3 there is no potential threat to those
4 people.

5 With regard to those 22 wells,
6 if there are residential wells that are
7 still active I believe Tang Realty
8 should be responsible for the cost to
9 connect them to the city water. The
10 reason is the owner, if there is a home
11 owner with an active well they would
12 have to connect to city water. I would
13 like to throw that on the table.

14 The question with regard to
15 clean up standards are they the result
16 of the risk assessment standards EPA put
17 on the screen or are they dictated by
18 the zoning on the site, would there be a
19 different clean up if this was zoned
20 industrial versus residential?

21 MR. HACKLAR: Basically it is a
22 combination of both. The risk
23 assessment showed us that there was a
24 threat from the soil and that PCB's were
25 a major factor. EPA does have a cleanup

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2 level for lead and because we saw that
3 they were exceeding that level we felt
4 it would be appropriate to remediate for
5 lead.

6 In looking at the areas to clean
7 up and not to clean up we did apply the
8 EPA cleanup criteria as a guide, so it
9 really is a combination of both.

10 MS. JACKSON: The even more
11 direct answer to the question, PCB's are
12 a good example. If we believe the site
13 is going to be used for residential, the
14 cleanup number for residential is 10
15 parts per million. We are not proposing
16 to go to 10. We are proposing to go to
17 one. We want to allow the site to be
18 used for residential, recreational.

19 ASSEMBLYMAN SMITH: If the
20 proposed use was industrial what would
21 be the number?

22 MS. JACKSON: The PCB's cleanup
23 number is 10. If we thought we were
24 going to have an industrial property
25 actually the guideline is 10 to 25. It

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could be as high as 25.

ASSEMBLYMAN SMITH: Would it be fair to conclude to that the most conservative approach is to keep the residential zoning in place because that requires the greatest degree of cleanup?

MS. JACKSON: As far as our using residential it is almost a more stringent cleanup number.

ASSEMBLYMAN SMITH: That was the whole point of question. I did not phrase it articulately. I know that is information counsel needs to know and that is very helpful. There is a statement in here on Page 19, "The State of New Jersey cannot concur on the preferred remedy unless its soil direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria."

What is the status of the State of New Jersey's response to your proposed cleanup or has there not been a

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2 response received?

3 MR. HARVEY: We have commented
4 on this proposed plan. The only
5 potential problem is the State's
6 criteria, it is not a standard, not a
7 law, for PCB's is .49 parts per million.
8 EPA criteria that they use is one part
9 per million, so there is a slight
10 different criteria. That is really the
11 main potential problem.

12 ASSEMBLYMAN SMITH: It is not a
13 happy thought, but I thought the
14 legislature passed a statute earlier
15 this session that indicated the State's
16 standard could not be more stringent
17 than Federal.

18 MR. HARVEY: That is true, but
19 there is not a law.

20 ASSEMBLYMAN SMITH: Keep up your
21 criteria. Fight hard for it. From an
22 environmental point we want to see the
23 site as clean as possible so please
24 continue to push for the .49.

25 What happens if you do not come

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2 to agreement. What happens if the State
3 does not agree with the preferred
4 alternative because their cleanup
5 criteria is more stringent than yours?

6 MS. JACKSON: There are a couple
7 of ways we can go. We would like to
8 approach the responsible parties in
9 negotiations and ask them to use the
10 State number because the State will
11 insist if we do not use their number and
12 do not meet it we leave restrictions on
13 the property, which we do not want to
14 do.

15 Our first hope is we will be
16 able to work it out to use the state
17 number, even though it is not law, but
18 we intend and we have been cooperating
19 all along and hope that will happen. If
20 that does not happen there are
21 alternatives. We can ask the State to
22 help us fund whatever additional cleanup
23 in order to meet their number.

24 Usually we can work it out in
25 negotiations. It is one of those

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2 regulatory points that we are familiar
3 with. It has happened at a couple of
4 other sites. We usually try to work it
5 out.

6 ASSEMBLYMAN SMITH: Does the
7 public and Mayor and council as these
8 negotiations proceed between the
9 responsible parties and the State, is
10 the local government informed of the
11 status of those negotiations? Does the
12 public ever know the status of those
13 negotiations?

14 MS. JACKSON: Not usually. The
15 legal document that would specify the
16 cleanup level would be the Record of
17 Decision. The public's opportunity to
18 weigh in, is now.

19 If there is a strong feeling on
20 the part of elected officials or the
21 public at large this would be the time
22 to make that clear.

23 ASSEMBLYMAN SMITH: I am very
24 happy that you made that point because
25 certainly everyone in the audience has

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to take that under advisement.

For myself I would endorse the State standard, the .49. Can you elaborate why the State picked .49?

MR. HARVEY: It is based on our own risk assessment work and that is done by our state scientists. That is all I really know. I do not know any details.

ASSEMBLYMAN SMITH: I would assume since it is a lower number it would result in lower risk numbers than on the overhead projector.

MS. JACKSON: It is not going to result in a huge difference. It is a lower number, a lower risk.

ASSEMBLYMAN SMITH: Has EPA quantified the cost?

MS. JACKSON: That is the interesting point. Right now there is no reason to believe it will cost any more. We are very hopeful. If you go to one you can go to .49. There are legal reasons but we believe we are

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talking about a difference of a couple
of shovel fulls.

ASSEMBLYMAN SMITH: For the
record, I am for the .49. As I read
this it appears you are talking about a
30 year timeframe for the cleanup
approximately plus or minus.

MR. ROBINSON: Yes, basically
for all groundwater treatment we use a
30 year as a standard for costing and
for evaluation, so what we do is we pump
and every five years we look at the data
that we have collected, reevaluate it
and make a decision whether we continue
pumping the way we have been pumping or
whether changes need to be made or
whether we shut down the facility
because we are within the cleanup
criteria.

ASSEMBLYMAN SMITH: My last
comment is congratulations for working
hard on this site, bringing it to where
it is. I know the people in Piscataway
appreciate the fact the Superfund

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2 cleanup is going forward. We know this
3 is an enormous expense. The technical
4 expertise is also enormous and we
5 appreciate the full force of the State
6 and Federal government to see that the
7 cleanup occurs.

8 That being said, I would also
9 endorse your proposals in terms of
10 cleanup. It sounds to me removal from
11 the site, while it is less expensive
12 than the cleanup at the site and the
13 groundwater alternative appears to be a
14 reasonable alternative as well.

15 The two things that are a little
16 unsatisfactory, I would like to press a
17 little harder on is the fact there needs
18 to be a way for the public and local
19 officials to know what the final status
20 of the negotiations are before its is
21 signed on the dotted line. I think
22 people want to know what is going to be
23 agreed to, what is about to be agreed to
24 before it is a done deal.

25 If there is some way to do that

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I would urge they consider doing that on the site because it is of such an important interest to the community.

The second comment I want to make is to urge that those 22 wells that maybe active need sampling and in the event there is contamination the responsible party be held responsible.

MS. JACKSON: You do not have to speak now but if there is anyone in this situation and you are interested in having your well tested please come up after the meeting. We would love to hear from you. It is not a problem to do the test. I think that is a good suggestion.

MR. BESON: I am Mike Beson, B-e-s-o-n. I work for Congressman Palone. I am here representing him tonight.

I wanted to thank the EPA for coming out. Clearly Assemblyman Smith is correct in saying this is a very good plan in the terms of the way you are

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2 getting rid of the soil and groundwater.
3 I think it is tremendous. Unfortunately
4 it had to take this long. I know we
5 have worked all in concert in trying to
6 make this happen. I just wanted to say
7 that we have to make sure that we test
8 as many off-site wells as we possibly
9 can. That is very important because we
10 have a responsible party and because of
11 off-site the groundwater contamination
12 we have to make sure we get to as many
13 off-site places as we can.

14 I encourage the people if you
15 have those wells please come up. I an
16 also agree with Assemblyman Smith about
17 the PCB's standard, please use the State
18 standard. The lower the standard the
19 better. Certainly if it is not costing
20 any more money it is probably the
21 smarter thing to do.

22 Alternative Groundwater 5,
23 Option B, that part of Option B it says:
24 "Starting up existing biological
25 treatment plan." Use of biological

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2 treatment plan will allow for discharge
3 into Stream 1A. Is that part of your
4 plan?

5 MR. ROBINSON: It may eventually
6 become a part of the plan. Currently we
7 prefer Option A and the plan that is in
8 operation now uses Option A but there is
9 also a possibility and PRP and they have
10 indicated that to us that in the future
11 they are not sure how much longer they
12 can continue releasing the treated
13 groundwater to the Middlesex County
14 Utilities Authority and in the event
15 that the Authority will not accept the
16 water any more we have to resort to
17 Option B.

18 What option B is is an
19 additional piece of equipment that goes
20 through an additional chemical process
21 and in this case it is a biological
22 process that will do an additional
23 treatment and will enable the water to
24 be released to the stream.

25 MR. BESON: I would encourage

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2 you to use the State standard. It is
3 very nice if things can be cleaned up to
4 a particular standard. In one case you
5 contradict yourself. You say on Page
6 16, "It is possible that it will be
7 technically impracticable to restore all
8 portions of the aquifers to meet State
9 and Federal standards."

10 I do not know if that has
11 implications to this.

12 MR. ROBINSON: No.

13 MR. BESON: Option B, releasing
14 it to the stream would be a last ditch
15 scenario. We have Assemblyman Smith and
16 Freeholder Brady. I know they would
17 work with our Utilities Authority to
18 make sure they would continue to accept
19 it.

20 The responsibility party should
21 do everything in its power to make sure
22 it does not have to be released. I
23 understand it would be within State and
24 Federal standards. If there is no
25 reason to do it you must pressure them

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and make sure it does not happen.

That was all I had to say.

Assemblyman Smith, on the final negotiations I would be happy to keep in touch with you to let you know where we are. If you could filter information about where we are I would be happy to get it down to the local and state level.

MR. HACKLAR: On the pumping availability, the status of the negotiations. One of the avenues that the EPA could proceed down with the responsible parties would be to enter into a consent order or administrative order on consent.

If that were the case it would go through a public notice period and the public would be able to comment on that.

MR. BESON: Okay. Thank you very much for coming tonight.

MS. SEPPI: Thank you, Mike.
Councilman Stewart.

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2 COUNCILMAN STEWART: I am Jim
3 Stewart. I am the Councilman for Ward 4
4 in Piscataway. On behalf of the people
5 of Ward 4 I would like to agree with
6 previous speakers and Assemblyman Smith.
7 We should ask for the .49 parts per
8 million, especially in light of fact it
9 is really not much more involved and not
10 much more cost, some sort of
11 bureaucratic thing that has to be worked
12 out.

13 If that is the case I urge you
14 to please try to work it out for the
15 benefit of the people and I know
16 Councilman Wahler before I came up here
17 asked me to state he also feels the same
18 way. He represents the people in Ward 2
19 in Piscataway. I see our Freeholder,
20 Camille Fernicola from Piscataway is
21 here too and she will have some comments
22 later on, her thoughts about this.

23 Also, I agree very much with the
24 comments about paying for the testing of
25 the wells in the neighborhood. I

1
2 remember back when this become an issue
3 and the people were just finding out
4 they had contamination in their wells,
5 part of the problem in the testing
6 involved was it was somewhat expensive
7 for the average homeowner to foot the
8 bill on a regular basis and I think to
9 go back down say to them you should pay
10 for testing the wells.

11 Even though it is a Superfund
12 Site out there I think it is sort of
13 unfair. If it could be worked out where
14 your agency could pay for the testing of
15 the wells I think it would be
16 appropriate. I think it would be a fair
17 thing to do. I also had some questions
18 I would like to ask, one having to do
19 with the actual logistics of trucking
20 away, I think you are talking about
21 18,000 cubic yards of soil. What is the
22 possibility for airborne dust and
23 contamination or rain water washing some
24 of the stuff down the streets and so
25 forth and so on.

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2 MR. ROBINSON: There is always
3 that possibility, but a lot of these
4 issues, health and safety issues they
5 will be addressed and the remedial
6 design and soil excavation is relatively
7 standard procedure in the construction
8 industry and they have measures that
9 addresses all of these things. We will
10 be going through that in the remedial
11 design.

12 MR. HACKLAR: Just to give you a
13 little bit about the historical
14 information, when we were building the
15 treatment plant out at the site
16 monitoring was done to determine the
17 level of dust in the air and especially
18 if trucks were going back and forth on
19 Flemming Street and if the dust was too
20 high the work would cease or there would
21 be some sort of dust suppression
22 measures.

23 There are very standard
24 measures. They are easily
25 implementable.

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2 COUNCILMAN STEWART: I think
3 compared to the soil excavation so far
4 this would be on the magnitude bigger.
5 There might have been a little dust here
6 and there on what you have done so far,
7 but it sounds like there is a potential
8 for contamination airborne into the
9 nearby residences.

10 We do have high density
11 apartment building in that area. There
12 are a lot of people living in that small
13 area. It worries me. I would like to
14 get some more information exactly what
15 those suppression techniques are. I do
16 not claim to be an expert but I have
17 seen trucks hauling away dirt. You can
18 see it blowing in the street. Not that
19 we have potholes in Piscataway but if it
20 hits a bump, you know, what I am saying.

21 I would like to get some more
22 detail.

23 MS. SEPPI: That is very common.
24 We have a lot of sites in construction
25 in New Jersey, especially with the

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2 summer we have had, it has been dry. We
3 can get you that information. Dust
4 suppression the perimeter air
5 monitoring, it is a problem that we have
6 at all sites. I think we have some
7 pretty good ways of handling it.

8 As we did with the treatment
9 facility we spend a lot of time with
10 people in the town engineering the
11 traffic. Everything will be worked out.

12 COUNCILMAN STEWART: Will we be
13 able to get more specifics on the
14 technology you will be using?

15 MS. SEPPI: Yes.

16 COUNCILMAN STEWART: I am glad
17 to see we are going to truck the soil
18 away and not leave it in place. I like
19 the option of pumping out the water by
20 putting more wells in.

21 One question I have, just before
22 the meeting we were talking informally
23 and I mentioned oil well drilling.
24 Sometimes they use very aggressive
25 methods for extracting the last bit of

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2 oil out. During the presentation you
3 were talking about having something like
4 three-quarters of a million dollars in
5 operating expenses for a number of
6 years.

7 I was wondering if more
8 aggressive techniques you would not have
9 to spend that much money. Is it
10 technically feasible in this type of
11 situation.

12 MR. ROBINSON: It is hard to say
13 whether it is technically feasible now.
14 I have spoken with representatives of
15 PRP and they have indicated to me that
16 is one of the options that they have
17 looked at or are looking at and so once
18 we sit down and start talking that will
19 be something to bring up.

20 COUNCILMAN STEWART: It might
21 actually be part of the final process.

22 MR. ROBINSON: Well, chances are
23 it would not be written into the Record
24 of Decision, but if we look at it and it
25 is feasible it might be a case where it

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can be amended and can be implemented.

COUNCILMAN STEWART: I would rather see it over with quicker, sooner than later.

MR. ROBINSON: If you look at operating costs at three-quarters of a million dollars a year if we can get it done sooner it only makes financial sense.

COUNCILMAN STEWART: Thank you, very much.

MS. SEPPI: Yes, sir.

MR. PROSUK: My name is Richard Prosuk. I live about two and a half blocks away from your site. I have four or five questions that these distinguished gentleman asked already so I only have one left now anyway.

You mentioned before about incineration. With the type of dirt and soil would that create any kind of smog or any kind of outlet into the atmosphere during the incineration process.

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2 MR. ROBINSON: Luckily we do not
3 have to worry about that because we have
4 not chosen that alternative. It is not
5 really incineration. It is very low
6 thermal desorption. It is like a big
7 cylinder turning around and once you put
8 this soil in there it has dust
9 collectors so it is more or less a
10 closed system and very little dust is
11 released to the air.

12 MR. PROSUK: Nothing escapes to
13 the atmosphere basically?

14 MR. ROBINSON: I would not say
15 nothing does not escape, but we have
16 safety measures there to try to collect
17 everything.

18 MR. PROSUK: It would be
19 monitored also; is that correct?

20 MS. SEPPI: That is not the
21 option we chose.

22 MR. PROSUK: I just picked up
23 that point when I was reading through
24 this.

25 MS. WOLFSKEHL: My name is

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2 Eileen Wolfskehl. I live at 1115 Kerwin
3 Street. I am a home owner. My concern
4 is -- well, you mentioned on Page 9 that
5 you have a concern about the risks, the
6 total cancer risk to potential future
7 residents at the site. Well, my concern
8 is the risks to the people who were
9 children 20 years ago and played at the
10 site.

11 What can we as parents expect of
12 our now adult children. There are a lot
13 of carcinogens on the site. Children
14 went there freely with there bicycles.
15 They played on a mound of what was
16 supposed to be inert materials.

17 They slid down these mounds.
18 They touched the dirt. I would like to
19 know, you know, what is the potential
20 risk of them coming down with cancer and
21 what kinds of cancer. I think that the
22 residents who have had their children
23 play on the site, we should be aware so
24 we know what too look out for.

25 MR. HACKLAR: This question has

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2 come up at past public meeting. The
3 community has been concerned about its
4 children 20, 30 years ago playing on the
5 site. Unfortunately, it is extremely
6 difficult, if not impossible, for us to
7 quantify a risk or even tell you what
8 types of risks from things that happened
9 so long ago.

10 We can tell you and we have told
11 you tonight and in our studies what the
12 current risk is if people, if children
13 go on the site today or if the site is
14 not remediated and children go on the
15 site a year or two or three from now,
16 but we are really not able to tell you
17 what the risk was in the 1970's or the
18 late 1960's from going on the site.

19 MS. WOLFSKEHL: Could you
20 translate that on Page 9, the
21 unacceptable total cancer risk 2.2 times
22 10 to the third, what does that mean?

23 MS. JACKSON: There would be an
24 additional two people out of a thousand
25 who can be expected, if they played and

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2 were exposed to the site on a regular
3 basis over a 70 year period to come down
4 with cancer because of their exposure at
5 the site as it is today.

6 Of course we have no samples
7 from the 1970's so we do not know what
8 the conditions were then. I am not a
9 physician, but I am an engineer and I
10 can put you in contact with someone to
11 talk about the risk. Fortunately one of
12 the things I can say is all of our
13 exposure assumptions are very
14 conservative and usually based on long
15 time period of exposure.

16 Usually with a child you are
17 talking about a child under age 15 from
18 say age 12 to 15 they did have a period
19 of exposure, one of questions is how
20 regularly they were over there and even
21 so that would be a seven to eight year
22 horizon as opposed to a 70 year horizon.

23 It is based on someone being in
24 and around that contamination every day,
25 it would assume, for instance if someone

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2 came and built a house on that site and
3 gardened every day. With children one
4 thing is they eat dirt, they make mud
5 pies.

6 MS. WOLFSKEHL: Or they do not
7 wash their hands before lunch.

8 MS. JACKSON: We do that too.
9 They sometimes run a higher risk. I
10 understand your concerns. If you want
11 to come up, we can put you in touch with
12 someone but a lot of questions you are
13 asking we just do not have the data to
14 answer because we do not have samples
15 from that time period.

16 MS. WOLFSKEHL: With the
17 particular type of carcinogens that are
18 there could you pin it down to the types
19 of cancers. Let's say children did play
20 there almost on a regular basis from the
21 time they were allowed to ride there
22 bicycles at the age of eight to, I do
23 not know, 12, 15 what kinds of cancers
24 would there be.

25 MS. JACKSON: I think we are

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2 talking about kidney. There was liver
3 in there. There were tumors that could
4 affect the nervous system. There could
5 be brain tumors. I do not feel
6 qualified to talk about that type of
7 tumors.

8 Those would be the systems that
9 would be effected. There are non-cancer
10 effects to the same kind of systems,
11 liver as part of the hepatic system and
12 your kidneys that do not end in cancer
13 but could still make you ill.

14 A lot of solvents affects the
15 systems of the body, especially if they
16 are eaten. I can't be more specific.
17 We are not qualified to answer that.

18 MS. WOLFSKEHL: Has the EPA ever
19 considered conducting a door to door
20 survey to find out how many people in
21 the neighborhood have died of cancer?

22 MS. JACKSON: We do not do that
23 type of work because we do not have
24 physicians in the agency. Congress in
25 the last law authorized an agency that

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2 is part of the Center for Disease
3 Control, the Agency for Toxic Substances
4 and Disease Registry. A lot of
5 questions you are asking it would be
6 really good if I put you one of our
7 biological scientists and they can do a
8 lot of those assessments.

9 MS. WOLFSKEHL: I am a measly
10 taxpayer that has no influence whereas
11 you are an agency that could say here is
12 a site, these people have been living
13 near the site raising children for over
14 20 years. You know, it is logical to me
15 that you would be the agency to
16 influence another agency to look into
17 this on our behalf.

18 MS. JACKSON: I will be happy to
19 request it tomorrow. If you want to
20 come up and leave your names I do not
21 have to wait for the transcript. I will
22 have him contact you to start that
23 process rolling.

24 I do not know whether it will
25 result in a full blown assessment or

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2 door to door survey because I do not
3 know how they do their medical
4 evaluations, but it does not require
5 that you petition and it is not going to
6 be they say no. They will come out and
7 talk to you and talk about your
8 concerns.

9 MS. SEPPI: They will be able to
10 tell you what they are able to do and
11 not able to do. All you have to do is
12 request it. It does not have to come
13 from another agency.

14 MS. WOLFSKEHL: I may be wrong
15 but from what I have seen of the site
16 only the plant is fenced in; is that
17 true?

18 MR. HACKLAR: No, the lot that
19 is identified as Lot 1B, which was
20 historically the area where the
21 industrial activities occurred that is
22 fenced in and that has been fenced in
23 for at least the last five years or so.

24 MS. WOLFSKEHL: Is that where
25 most of the contaminants were found

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also?

MR. HACKLAR: The majority of
contamination is in Lot 1-B.

MS. WOLFSKEHL: All right.

MS. SEPPI: Councilman Wahler.

COUNCILMAN WAHLER: Councilman
Brian Wahler, Ward 2. It was brought to
my attention by one of my constituents
sitting behind me on Page 17 with the
Alternative S-3 you talk about the EPA
will also bypass the residential areas.
Right now you are using Flemming Street
for that. Do you have anywhere that
road might possibly go? I have the map
where the site is. I think that is on
Page 3.

MS. SEPPI: Do you want the map
up?

COUNCILMAN WAHLER: Let our
planning division know. Maybe we can
work with you on that, where it would
the least impact the residents.

MR. BILLIMORIA: This is Lot 1-A
and on the other side of this stream,

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2 this property there is a narrow strip
3 which is also owned by Tang Reality and
4 it fronts onto, I guess this is New
5 Brunswick Avenue.

6 COUNCILMAN WAHLER: Yes, that
7 would be New Brunswick Avenue.

8 MR. BILLIMORIA: It is a little
9 bit north of cardboard factory. It used
10 to be a drum operation. It is at the
11 corner of the railroad and south
12 Brunswick Avenue. Just north of that
13 there is a little access road that is
14 owned by Tang Realty and that could be
15 used that way, you bypass the apartments
16 or the residences on the other side.

17 COUNCILMAN WAHLER: Maybe could
18 you possibly contact the Mayor's office
19 so we can work with if you do go with
20 that. That might be an acceptable
21 route. I do know the county is going
22 into reconstruct Stelton Road. I am
23 sure you are not talking about starting
24 moving the earth any time soon.

25 MS. SEPPI: We will cooperate

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2 with everyone.

3 COUNCILMAN WAHLER: I agree with
4 all at statements that Assemblyman Smith
5 and some of my colleagues. If the
6 residents want to test their wells I do
7 believe that maybe the responsible party
8 should be picking up the cost of hooking
9 up to the water system.

10 On average if you have someone
11 come anywhere from a thousand to 1,500
12 depending upon the distance and most
13 people do not have a thousand or 1,500
14 to hook up immediately, so please keep
15 that in mind when you do negotiate a
16 settlement.

17 MR. MAGLIETTE: Ralph Magliette,
18 Chairman of Environmental Commission and
19 I have a couple of technical questions
20 to ask.

21 On Page 6 and 7 we have
22 Contaminants in Surface and Subsurface
23 Soils, a list of contaminants and on
24 Page 7 Contaminants in Groundwater. Can
25 you provide the list what the MCL would

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2 be for each of the contaminants you have
3 listed. Could I get that data because I
4 couldn't look up all the compounds and
5 find them.

6 MR. HACKLAR: We can get that to
7 you. Just for the public's information
8 that would be in EPA's remedial
9 investigation report, if you have to
10 time to look through it, but we can gets
11 you a copy of the MCL.

12 MR. MAGLIETTE: This table is
13 great but what level do we have to get
14 down to. You never say we need to get
15 down to one part per million or one part
16 per billion. We know what the actual
17 extent of the removal has to be, okay.

18 The other question I have is I
19 am going back to this treatment site you
20 have, going to Page 14. I was under the
21 impression that the pumping and
22 treatment facility as it is now has both
23 an air stripper followed by activated
24 carbon absorption. That being the case
25 why would the Sewage Authority not want

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1
2 the treated groundwater, if you removed
3 greater than 99 percent of all the
4 organic contaminants, you gave the data,
5 you had a high removal, is there a
6 reason why you think they would not let
7 you pump basically almost portable water
8 in the sewer?

9 MR. HACKLAR: There are several
10 possible reasons. Just being the
11 appearance of Superfund water going
12 through a public collection system,
13 through a treatment plant. Another
14 reason being that it is taking up space
15 in a collection and treatment system and
16 I do know, it is not necessarily with
17 MCUA but other sewage authorities space
18 can be at a premium.

19 MR. MAGLIETTE: Do you feel that
20 50 gallons per minute is an excessive
21 flow rate, that they could not take
22 that.

23 MR. HACKLAR: I do not know what
24 capacity MCUA has. If they are under
25 any restrictions due to any requirement

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by the Clean Water Act. I could not comment on that.

MS. WOLFSKEHL: The soils that are contaminated with PCB's, are those also the same hot spots where the organic contamination is?

MR. HACKLAR: They are co-located.

MS. WOLFSKEHL: If we were to excavate the soil that has both there is a possibility we might have volatile in the air when you put it into the air and put it on the truck.

MR. HACKLAR: That is a possibility.

MR. MAGLIETTE: I am not familiar with all of the new methods of disposal. Are you going to have completely sealed trucks so you do not have VOC emissions come off the soil when it is trucked away or are you going to put a tarp over it?

MR. HACKLAR: At this point we have not made a decision on that. As

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1
2 the excavation is proceeding there will
3 be procedures to monitor dust and also
4 organic emissions so if we do see a
5 problem we will correct it.

6 MR. MAGLIETTE: If you look at
7 the list of the soils and look at the
8 organics we have carbon tetrachloride
9 which has a very high vapor measurement.
10 If you excavate it and striped all the
11 VOC down it is in the air in an area
12 that is highly densely populated.

13 I understand it is a small
14 amount per say, but my question is are
15 you going to build in additional
16 safeguards to protect the residents,
17 what do they normally do?

18 MS. JACKSON: The main
19 suppression method is water or the use
20 of some type of cover, not a fully
21 enclosed vehicle but a tarp.

22 With the low levels we see at
23 the site, I think the risk assessment
24 did not show a risk of inhalation of
25 volatiles at that site so the levels are

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not high enough to show a risk. We would be careful, but we would not spend money just to be spending it.

MR. MAGLIETTE: When you say you are going to truck the material off-site, are you going to dispose of it and treat it?

MR. ROBINSON: We are disposing it.

MR. MAGLIETTE: You are taking the contaminated soil from Piscataway and putting it in somebody else's backyard and burying it? You are not detoxifying the soil?

MR. HACKLAR: Before any of the soil is disposed of it will be tested to determine if it is in fact a hazardous waste as defined by the Resource Recovery Act.

Depending on what the waste is, whether it is classified as hazardous waste or non-hazardous waste that will determine where the material will go. If it is determined to be hazardous

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2 waste and meets the criteria and we have
3 EPA special tests for that then it would
4 go to a facility that is operating in
5 accordance with RCRA.

6 MR. MAGLIETTE: Let us say
7 PCB's which is exquisitely toxic and
8 find some supplier or some waste
9 generator or shipper who is going to
10 take this waste and just bury it
11 somewhere else, are you going to blend
12 it to reduce the concentration of PCB'S?

13 MR. HACKLAR: It would be placed
14 in a commercial RCRA disposal facility.

15 MR. MAGLIETTE: Not that I would
16 want to have the waste treated on site,
17 but is it not better to detoxify the
18 soil? It is almost like you are saying
19 dilution is the solution.

20 We have soil that has x PCB
21 concentration. We are going to mix it
22 in non PCP soil. If we are below the
23 EPA number then it is safe. I would not
24 agree it is better to do it for this
25 site.

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2 MS. JACKSON: We have to look at
3 cost when we look at cleanup
4 alternatives. There is a couple of ways
5 that allows you to get rid of five
6 hundred parts per million. We would be
7 required to incinerate it. We are not
8 talking about levels above that.

9 MR. MAGLIETTE: If you look at
10 Page 6 you have levels of 21 to 2,600
11 and 540 to 310,000 parts per billion so
12 that would be 310 parts per million.

13 MS. JACKSON: That is the
14 highest level in soil. We are not
15 required by law to do the incineration.
16 Land disposal in a commercial facility
17 regulated by the Federal and State
18 government is acceptable. In this case
19 isn't it better the EPA is saying no, we
20 prefer the land disposal. We have to
21 look at cost at this and all the other
22 sites.

23 MR. MAGLIETTE: You have done
24 the ecological risk assessment. I was
25 concerned if sedimentary toxicity

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testing had been done.

MR. HACKLAR: It was not performed. It was a qualitative and quantitative assessment similar to what we performed for the human health risk assessment, where we looked at reasonable maximum exposures but it was felt at this stage the actual laboratory tests were not warranted.

MR. MAGLIETTE: Would you not postulate that there would be at the very least heavy metals in the sediment of runoff after all these years?

My question is twofold. I am not trying to bait you on it. Is the fact we may in some future date not be allowed to discharge to the sewer utility, we are going to be pumping 50 gallons per minute into the stream. At that flow rate you may have start sediment toxicity testing, which was not done previously, because you might be enhancing the toxicity as it goes through the channel because it is a very

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shallow --

MR. HACKLAR: The streams on site, when we talk about streams they are really in essence just intermittent ditches. At certain times of the year they do not have any flow.

While there were contaminants detected in the sediment we are addressing the soil and as we go through we do believe that we will be removing the contamination that would be causing any of the problems.

You are only talking about sediment here. In essence you are talking about soil just because the streams are in the ditches.

MR. MAGLIETTE: Right, but we have no data to base it on. That is all supposition.

MR. HACKLAR: The sediment values, the results are compared to toxicity values in the ecological assessment which is really our first step. We would not initially jump to

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the laboratory tests at this point.

MR. MAGLIETTE: You have reference data that you have made that calculation?

MR. HACKLAR: Yes, that is available in the remedial investigation.

MS. PICCIUTO: Hi, my name is Rosemary Picciuto. I also am a local residence of Piscataway for 32 years. I live on Charter Street. My children also played to that mound of dirt and I am worried, they are now of child bearing age. We have to worry about the future generation.

Also, did you know in 1966 there was a town picnic at this site also to celebrate the 300th anniversary of this township. We had a big picnic. I think we all should have been notified before that this was contaminated and it was a risk to all of us.

When I bought my house in 1965 I was not notified. If I want to sell my house today I have to notify the people

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2 I am in a Superfund Site and that
3 decreases the value of my home. I do
4 not think it is fair for you taking so
5 long. I have been living with this for
6 32 years. I will be dead and buried by
7 then.

8 MS. SEPPI: I think someone else
9 had a question.

10 MR. COSTELLO: My name is John
11 Costello. I have some questions about
12 this site. On the excavation are you
13 excavating Lot 1-B or both 1B and 1A?

14 MR. ROBINSON: Most of the soil
15 will come from Lot 1-B. Some of the
16 excavation will come from Lot 1-A also.

17 MR. COSTELLO: Just the part of
18 1A around 1B basically?

19 MR. ROBINSON: Basically.

20 MR. COSTELLO: How far down are
21 you going to excavate?

22 MR. ROBINSON: Well, --

23 MR. COSTELLO: You are saying
24 18,600 cubic yards. I am not sure what
25 that is going to translate into.

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2 MR. ROBINSON: It varies from
3 area to area basically based on soil
4 testing that we have done and for each
5 particular area and it is all in the
6 remedial investigation.

7 For some areas we might to go
8 two feet, for some areas four feet and
9 other areas six feet. It varies.

10 MR. COSTELLO: Would it be fair
11 to say six feet is the deepest you are
12 planning to go?

13 MR. ROBINSON: Basically, yes.

14 MR. COSTELLO: About how long
15 after the excavation is done would
16 houses potentially start going up if
17 approvals were made?

18 How quickly after you finish the
19 excavation could houses be built or
20 would we have to wait for the 30 years
21 for the ground groundwater also?

22 MS. JACKSON: There would not be
23 a restriction on time. I do not think
24 there is any way I could guess the
25 timeframe. My guess it would be

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2 difficult to have an attractive piece of
3 property while the treatment plant is
4 operating so it is really impossible for
5 me to give you an answer to that
6 question.

7 MR. COSTELLO: Well, then the
8 allotted time is 30 years, then would it
9 be fair to say that it probably would
10 not be off the NPL list until 30 years
11 from now or sometime or would it
12 probably be off sometime before that.

13 MS. JACKSON: Let me clarify one
14 point. The 30 years in the plan for
15 groundwater pumping and treatment is not
16 an estimate of how long it will take to
17 clean up the site.

18 Because of the fractured bedrock
19 underneath it, it is really rock with
20 cracks and fissures running through it,
21 contaminants get trapped in spaces. It
22 does not take a lot of contamination to
23 detect a part per billion or two.

24 So what we have tried to do
25 here, and I think it is a very important

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2 point, I have been kind of itching to
3 say, in our objectives is to pump as
4 much of the water from the site facility
5 as we can very aggressively and we are
6 saying five wells could be worked out in
7 design to try to remove the
8 contamination but also to insure that
9 the contamination does not leave those
10 facility's boundaries.

11 It is very difficult for our
12 scientists and Mr. Billimoria could
13 probably speak for hours. He said he
14 could probably write another
15 dissertation on it to come up with a
16 timeframe. While MCL's are important,
17 our first goal is to try to pump it and
18 try to see what response we get.

19 It could be longer than 30 years
20 or it could be shorter than 30 years.

21 MR. COSTELLO: You have no way
22 of knowing until you have done the
23 process and you will check every five
24 years. If it is done in five years then
25 it would be ready for the houses.

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MS. JACKSON: It would be ready to start the deletion from the NPL list.

MR. COSTELLO: How long does that take to delete it?

MS. JACKSON: It requires by law we publish notice in the public register and allow for 60 days of public comments and final notice where we hereby notify one and all this site is hereby off the list.

MR. COSTELLO: That process about six months.

MS. JACKSON: About.

MR. COSTELLO: How deep is the contamination, how far down?

MR. HACKLAR: The contamination goes down several hundred feet, the groundwater contamination.

MR. COSTELLO: What about the soil contamination?

MR. HACKLAR: The soil there is roughly 10 feet or less of soil throughout the site and we are looking at contamination, like I said, roughly

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probably six feet or so.

MR. COSTELLO: Up to six feet is what you are planning to excavate?

MR. HACKLAR: Roughly.

MR. COSTELLO: Say it is all cleaned up and off the priorities list and houses are ready to be built, there are going to be basements, holes dug in the ground for basements.

Okay, and I believe that they would be going down more than the six feet. What happens to the another four feet that you are talking about? There is 10 feet of soil, you know, where the contamination is.

MR. HACKLAR: What we have observed at the site is that when you are talking about the subsurface you get infiltration through rain and then what you really get, you get a flushing of contaminants into the groundwater because the site has been around for so long.

What we are finding is

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1 relatively speaking that the groundwater
2 is more contaminated than the soil.

3 When the groundwater pumps and treatment
4 is expanded and is running what you will
5 essentially find is really almost a
6 dewatering of the area. In effect any
7 water that is coming in will most likely
8 migrate downward and will be captured by
9 the pump and treat system, so the
10 potential threat from contaminated
11 basements would obviously be from any of
12 the groundwater, but the groundwater
13 would be controlled.

14 MR. COSTELLO: Let me see if I
15 understand this now. Basically you are
16 going to take out the excavated soil, a
17 certain amount of soil?

18 MR. HACKLAR: That is correct.

19 MR. COSTELLO: You are going to
20 remove or treat the groundwater?

21 MR. HACKLAR: Right.

22 MR. COSTELLO: As you have less
23 and less contamination in the
24 groundwater is it safe to assume there
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is less and less contamination in the
subsoil?

MR. HACKLAR: We will be
removing all the soil that would have
posed a threat. One of the pathways we
looked at in the risk assessment was any
risks to construction workers out at the
site or workers that would be digging
holes for whatever reason, for basements
or whatever, and we feel that through
what we are proposing today, that any of
those risks would be addressed before
anything would be built on site.

MR. COSTELLO: So like all this
contaminated stuff that would be left in
the subsoil would tend to filter down to
the groundwater?

MR. HACKLAR: There would not be
a contamination that would pose a risk.

MR. COSTELLO: I understand
that. What happens to all these things
as it continues to filter down?

MR. HACKLAR: Whatever minimal
amount would be in the subsurface would

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2 continue to basically migrate downward
3 as rain water and filtration would
4 percolate there.

5 MR. COSTELLO: That is about it
6 since we talked in great detail on the
7 groundwater and I kind of understand
8 that now.

9 I would also like to say the
10 more you can do to protect the site the
11 better. That is what I want to say.

12 MS. MASON: My name is Phyllis
13 Mason I am running for Assembly in this
14 district and giving myself a quick crash
15 course on toxic sites because we seem to
16 have several of them.

17 I have a few questions and I
18 will be as fast as I can. First of all,
19 your plan shows Stream 1A and Stream 1B
20 all flowing, merging through the site
21 and presumably continuing north. Where
22 do they go?

23 MR. HACKLAR: Ultimately the
24 streams and ditches could be tributaries
25 to the Bound Brook. They ultimately go

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2 to, I believe it is here. You can
3 correct me if I am wrong. It Goes to
4 New Market Lake, which really down
5 stream ultimately goes to the Raritan
6 River.

7 MS. MASON: I figured that was
8 perhaps where they went if they were
9 going north. The reason I am asking
10 that question is I know with the PCB's
11 from South Plainfield flowing into the
12 Bound Brook they are testing far beyond
13 the borders of the site and in fact the
14 boarders past New Market Pond for PCB's
15 and I am wondering before you clean it
16 up if you will also extend and do some
17 testing beyond this site of the Bound
18 Brook and along it to make sure nothing
19 has gotten out there.

20 MS. JACKSON: I am thinking, the
21 areas of the Bound Brook -- you are
22 asking for sampling of areas of the
23 Bound Brook that are not being sampled.
24 We are doing an extensive sampling along
25 the Hamilton Industrial Park site.

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MS. MASON: At least up to it.

MS. JACKSON: We will know, I guess, whether there are PCB's in the Bound Brook. I think we suspect there are.

MS. MASON: This stream or network of streams following the stream, following up to the Brook, I do not know where it really goes.

MS. JACKSON: If these were streams and ran above ground and we could say they were running into the Bound Brook and contributing to it I would say of course it would have been part of the study.

The levels of PCB's found in those ditches and streams were very low. They did not pose a threat to warrant us taking an action in the stream. Now, I suppose the only other question is in the past were there any levels.

What I would like to is sit down with the guys. We actually scheduled a meeting a couple of days ago. Once they

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2 get the results back from their Bound
3 Brook samples, we will sit down and look
4 at it. We are thinking along those
5 lines and I do not know what the answer
6 is to the question.

7 MS. MASON: My second question
8 has to do with risk and the concept of
9 potential risk. This has already been
10 raised, but the plan talked several
11 times about potential risk to humans and
12 also potential risk to wildlife in
13 particular three different species of
14 birds.

15 I do not remember which they
16 were. I remember there were three of
17 them. Now, since this plant has been in
18 existence since the 50's and these toxic
19 chemicals have been produced and flowing
20 wherever they go and going wherever they
21 go, although you do not take surveys
22 does anybody look at medical records for
23 higher incidents of cancer in this area?

24 No. 2, are there any kind of
25 records of an abnormally large number of

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2 dead birds, mutated birds, anything like
3 that that might indicate if you are
4 going to assess the risk and come up
5 with an alternative to solve the problem
6 I would think that you really have to
7 try to find out what has taken place so
8 far, what harm has actually taken place.

9 MS. JACKSON: The agency I
10 mentioned before would do the evaluation
11 of that. We are going to petition to
12 see what they can do at this site. On
13 the fish and wildlife side I do not have
14 any specifics because again I am an
15 engineer, but the sites I have worked on
16 where we have had severe impacts to fish
17 and wildlife, in those cases you can do
18 studies of fish living in the stream and
19 wildlife living around the area.
20 Because of the type of area this is we
21 are not talking about a lot of species
22 so I could not see it doing it.

23 MS. MASON: My last two
24 questions have to do with disposal and I
25 think they are pretty fast. This is a

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1
2 really genuine question. When you talk
3 about the MCUA might not accept this
4 flow why might they not accept it? Is
5 it because of their capacity or because
6 of the toxicity or what?

7 MR. HACKLAR: I cannot speak for
8 MCUA. I am not sure at this point
9 whether it is a capacity issue. In
10 other utility authorities there are
11 capacity issues. It could be that.

12 They are under a discharge
13 permit to discharge their water and they
14 could possibly be concerned about levels
15 of effluents or in their treatment plant
16 they have to deal with the sludge they
17 generate. They could be concerned with
18 that or it could possibly be a
19 perception issue, just accepting waste
20 water.

21 I do know as of several years
22 ago, and again I have not had contact
23 with personnel from MCUA in recent
24 times, but their policy on Superfund
25 waste water or groundwater is if there

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1
2 was another option for the groundwater
3 then they would be very reluctant to
4 take the water themselves?

5 For example, if there was the
6 option to discharge in a surface water
7 body they would be reluctant to take the
8 water themselves. That is why the
9 system that is out there today was
10 designed to basically go either way.

11 We are currently discharging to
12 the sewer system. The whole treatment
13 process and the outflow pipe is in place
14 to discharge to the stream if that were
15 to be the case.

16 MS. MASON: My final question is
17 somebody raised a concern earlier about
18 dirt removal and dirt blowing off trucks
19 and through residential neighborhoods
20 and so forth.

21 It occurred to me looking at the
22 map since you have a railroad going
23 right by the site have you considered
24 putting the dirt in closed cars and
25 taking it out of the my cars and to the

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railroad.

MS. JACKSON: That was my question and they laughed at me because it must been looked at and it is not an inexpensive proposition. 18,000 cubic yards sounds like a lot of dirt. It is not a huge amount compared to some places, so trucking would be much more economical and would probably be the best way.

I can't remember when you walked the rails what was your final determination?

MR. BILLIMORIA: it can be done but there is a lot of steps you would have to go through. You would have to consider rail accidents like the one that occurred not very far from that location just a few weeks ago.

MS. MASON: That is true, but of course there could be a truck accident

MR. BILLIMORIA: I know that.

MR. HACKLAR: I walked with Meyhear the railroad that day.

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2 Theoretically it is doable. It would be
3 expensive. It would take a lot of
4 coordination with the railroad itself.

5 We would probably have to build
6 a new site. There would be issues in
7 terms of bringing, of actually digging
8 the soil out, putting it on let it say a
9 truck to transport it to the site that
10 we would build and loading it on a car
11 there. There would be a lot of
12 intermediate steps before you would get
13 it onto the railroad car.

14 MS. MASON: What if it were done
15 with containers?

16 MS. SEPPI: It would still be
17 the same problem. You would have to
18 truck it to the site, put it in the rail
19 cars, put it into another truck to get
20 it to your permitted landfill.

21 MR. HACKLAR: Also where the
22 site, just by necessary would need to be
23 placed, would it be located close to
24 when the land areas which would entail
25 building a good access road to the site.

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2 It is an alternative that could be done,
3 but it is not easily implementable. The
4 trucking alternative is much more
5 implementable.

6 MS. SEPPI: Okay, just keep it
7 in mind. Before we go on could I just
8 have a show of hands of how many more
9 people want to speak? Our court
10 stenographer probably needs a break.

11 (A short recess was taken.)

12 MS. SEPPI: If everyone is ready
13 let us go on with the rest of the
14 questions.

15 FREEHOLDER FERNICOLA: I am
16 Camille Fernicola, Freeholder and former
17 Piscataway Councilwoman. I become a
18 Councilwoman in 1979 and right after
19 that I remember a young man came to us
20 who lived in the neighborhood around the
21 Chemsol site and his name is was Ralph
22 Magliette and he is now our
23 Environmental chairman and he has been
24 for many years and Ms. Wolfskehl brought
25 to us the problem of leaching and all

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2 the chemicals at that time a housing
3 development was proposed and they as
4 ordinary citizens were very concerned
5 about their neighborhood and township
6 and brought it to our attention and
7 Assemblyman Smith was a Councilman at
8 the time and he later become Mayor and
9 we have been dealing with this obviously
10 for many years.

11 The first ten years or so
12 nothing was done physically on the site.
13 It was going around in the courts. The
14 lawyers were sending their grandchildren
15 to college and it just went on and on
16 and I remember the voters also adopted
17 the Chemsol Site as their own and made
18 it a point to have an annual program.
19 It was about seven or eight years ago we
20 really saw movement.

21 Several years ago the Mayor and
22 council had the opportunity, we were
23 invited to view the site and the
24 transformation was wonderful. Many
25 people are still upset, and I cannot

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2 blame them, for the health of their
3 family, especially the ones that have
4 been there for many years, but like I
5 said the transformation that we see now,
6 there is grass growing, the plant is
7 cleaning up the water.

8 Yes, it may take 30 more years,
9 but at least something is being done and
10 I thank you for coming tonight. You are
11 a very fine team that I can see and it
12 looks like you are on top of everything.
13 You are working hard at making the
14 Chemsol Site a Superfund Site of the
15 past and back in 1979 nobody ever heard
16 the term Superfund and now it rolls off
17 everybody lips. Soon we hope that this
18 Superfund Site will die a death and we
19 will all have a party.

20 Thank you, very much for all the
21 information you have given us tonight.

22 MS. SEPPI: Thank you. One
23 thing I would like to say is Superfund
24 become a law in 1980. That is why no
25 one heard of it in 1979.

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2 That is why we did not do
3 anything. EPA did not start until 1970
4 and Superfund 1980 and 1984. It still
5 has been a long time but your right some
6 things have been accomplished and
7 hopefully this will be the end of things

8 FREEHOLDER BRADY: I am Jane
9 Brady, Freeholder/Director of Middlesex
10 County. I want to thank you for being
11 here and straightforward with all of
12 your information.

13 You have to understand, of
14 course, Middlesex County has 12
15 Superfund Sites. We have more than any
16 county. We are greatly concerned about
17 not only Chemsol but the other sites as
18 well, also quite honestly the length of
19 time that it is taking for the EPA to
20 get around to these sites and the
21 damaged is around the county.

22 I encouraged you to move as
23 quickly as possible to make sure
24 everything is taken care of. We are
25 gravely concerned. So many of our

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2 sites, some of them have been removed
3 from the priority list. I urge you to
4 please use your influence to encourage
5 more cleanup in Middlesex County so we
6 can feel more comfortable to use them
7 for recreational purposes or whatever
8 might be the best use. The MCUA have
9 they indicated to you they will not
10 accept this water, or is this just a
11 possibility? I would like that
12 clarified, if possible.

13 MR. HACKLAR: At this point we
14 have not had direct contact with them on
15 this matter. At this point it is a
16 possibility.

17 FREEHOLDER BRADY: They have not
18 said no?

19 MR. HACKLAR: We have not had
20 contact with them.

21 FREEHOLDER BRADY: Thank you,
22 very much.

23 COUNCILMAN STEWART: I just had
24 one final comment I wanted to make and I
25 remember making the same point at the

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2 time Ms. Fernicola went to visit the
3 brand new facility cleaning up the site.
4 As you pointed out your agency did not
5 really exist until 1970 and the
6 Superfund Law did not go into effect
7 until 1980.

8 This plant was there in the
9 1950's causing that contamination. That
10 was sort of a heyday of industrial
11 growth with little or no regulations. I
12 know Assemblyman Smith when his party
13 was in the majority party and he worked
14 very hard too make sure that New Jersey
15 had adequate regulations to prevent that
16 sort of thing, but I know more recently
17 there has been more talk of deregulation
18 and certain feelings that maybe industry
19 is regulated too much, there is over
20 regulation and it is more than
21 necessary, but as a counter argument all
22 I have to do is point to the Superfund
23 Site in my ward.

24 Whereas the Freeholder Director
25 was pointing out the 12 sites in

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2 Middlesex County I would like to put on
3 to the official record my hope that the
4 taxpayers take these Superfund Sites as
5 a message that we in fact need
6 regulations, government regulations at
7 the state and federal level to insure
8 the quality of our environment and the
9 quality of all of our lives and
10 children's lives so never again will we
11 have to listen to the impassioned
12 please, my children played there and
13 about township picnics, on that how
14 could this be.

15 This came about because of the
16 lack of adequate regulations. I just
17 want to make sure I get that on to the
18 record. Thank you, very much.

19 MR. COSTELLO: I had one final
20 question. After you excavate the soil
21 you are going to put new soil down, I
22 presume. Where are you going to be
23 getting that soil from?

24 MR. ROBINSON: The soil WILL be
25 coming from some off-site facility. We

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1
2 do not know where yet, but wherever it
3 comes from the soil will be tested to
4 make sure it is clean before it is
5 brought to the site.

6 MR. COSTELLO: Could it be soil
7 that had been previously contaminated
8 and now officially clean, could that be
9 a possibility?

10 MR. ROBINSON: Highly unlikely.
11 We basically do not go through that
12 route. We normally just go to an area
13 and take virgin soil, but we test it
14 before we bring it to the site.

15 MR. COSTELLO: Take part of a
16 mountain and put it there?

17 MS. SEPPI: There are plenty of
18 facilities in New Jersey that we get
19 soil from for our sites, let alone going
20 to another site if we had to.

21 MR. COSTELLO: If it is deemed
22 really hazardous this soil that you are
23 going to be excavating from the site
24 where exactly does it go?

25 MR. ROBINSON: If it is deemed

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2 really hazardous it will end up at what
3 we call a RCRA facility, which is
4 regulated by the State and Federal
5 government.

6 MR. COSTELLO: Where is the
7 closest one to Piscataway?

8 MR. ROBINSON: I am not sure.

9 MR. BILLIMORIA: We did not use
10 any particular one.

11 MS. JACKSON: Just estimated
12 distance.

13 MR. BILLIMORIA: I understand
14 there is possibly one in Pennsylvania.

15 MR. COSTELLO: I heard there is
16 a large one in Alabama.

17 MS. JACKSON: Yes. Thank you.

18 MR. SCHANCK: I just have a
19 couple of questions. Thank you. My
20 name is Garrett Schanck. I am a home
21 owner and I just have a couple of
22 questions for clarification on that
23 business of the statistical analysis
24 here of 2.2 per thousand.

25 If a person, such as a child,

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2 people are concerned about that were
3 playing on that for a few years, okay,
4 how does that compare to this risk
5 assessment here which the way I
6 interpret it, if I am not wrong here, if
7 you have 2.2 per thousand over 70 years,
8 is that a continual 70 years exposure?

9 MS. SEPPI: Yes.

10 MR. SCHANCK: Let us say you had
11 a homeless guy sitting out there for say
12 70 years, two of them statistically
13 would get cancer?

14 MR. HACKLAR: Yes.

15 MR. SCHANCK: That is what you
16 are saying to is the risk to that site?

17 MS. JACKSON: Yes.

18 MR. SCHANCK: It seems kind of
19 small. Obviously if someone gets cancer
20 they are very concerned. The other
21 thing is the last time I was here and
22 this time there was a lot of information
23 or a lot of discussion on why it took so
24 long. There is a woman out there almost
25 in tears going out of here very upset

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2 about why it took so long, lawyers
3 haggling about what-have-you, is it a
4 possibility why this took so long, one
5 of reasons was because you had to find a
6 person to pay for this thing like Tang
7 Realty?

8 Did it take so long because by
9 law you had to find somebody at fault or
10 could this money just come straight out
11 of the Superfund money and been taken
12 care of 20 years ago.

13 MR. HACKLAR: What happens is
14 that the site was placed on EPA's
15 National Priorities List in 1983. Once
16 that happens the government can spend
17 money on the site to investigate and to
18 clean up the site.

19 Now, what happened during the
20 1980's the site was being investigated
21 initially by the site owner, Tang Realty
22 and the NJ DEP was overseeing that
23 investigations. Data was collected,
24 material was removed from the site, but
25 because it was taking the site owner a

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2 very long time to do their
3 investigations, both DEP and EPA jointly
4 decided it would be in the best interest
5 of the project to get it really moving
6 along to basically transfer the site to
7 EPA and have EPA perform the studies
8 itself.

9 MR. SCHANCK: What year was
10 that?

11 MS. SEPPI: That was 1990.

12 MR. SCHANCK: Okay, I
13 understand. I guess the last question I
14 have, a LOT of people are concerned
15 about transportation of soil in case a
16 dump truck dumps it on the ground. I am
17 kind of curious I guess PCB's is the
18 biggest concern?

19 MR. HACKLAR: PCB's and lead.

20 MS. WOLFSKEHL: If this soil
21 overturns what is the risk if you are
22 talking 70 years to be a problem, if a
23 dump trucks dumps over accidentally for
24 whatever reason, an accident or whatever
25 it is a big two tons of soil being

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1
2 picked up in a matter of what, a couple
3 of hours?

4 That is a far cry from 70 years.
5 I mean it seems to me maybe we are a
6 little bit over concerned there. It
7 just seems to me, that is just my
8 opinion on that. That is it. Thanks
9 very much. I appreciate your time.

10 MS. SEPPI: Thank you.

11 Are there any other questions?

12 (No response.)

13 MR. SEPPI: All right. Well, we
14 thank you again for coming. You have
15 the names and phone numbers on the
16 proposed plan. Do not hesitated to call
17 any of us at any time.

18 If anybody has information they
19 want to give us about a well they need
20 tested please come up and if anybody is
21 interested in the ATSDR we can give you
22 that number also. Thank you.

23 (Whereupon, at 9:30 o'clock p.m.
24 the proceedings were concluded.)
25

100111

C E R T I F I C A T E

STATE OF NEW YORK)
COUNTY OF NEW YORK) ss.

I, TINA DeROSA, a Shorthand
(Stenotype) Reporter and Notary Public
of the State of New York, do hereby
certify that the foregoing Proceedings,
taken at the time and place aforesaid,
is a true and correct transcription of
my shorthand notes.

I further certify that I am
neither counsel for nor related to any
party to said action, nor in any wise
interested in the result or outcome
thereof.

IN WITNESS WHEREOF, I have
hereunto set my hand this 5th day of
September, 1997.



TINA DeROSA

100112

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - B

**Written comments received by EPA during the
public comment period**

PITNEY, HARDIN, KIPP & SZUCH

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October 10, 1997

VIA HAND DELIVERY

Nigel Robinson
Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007

Re: Comments on Remedial Investigation, Feasibility Study, and Proposed Plan
Chemsol, Inc. Superfund Site, Piscataway, New Jersey

Dear Mr. Robinson:

Enclosed, on behalf of the Chemsol PRP Group (the "Group"), are a Technical Review of the Remedial Investigation Report¹ and Comments on the Feasibility Study ("FS") and Proposed Plan for the Chemsol, Inc. Superfund Site (the "Site"). The comments address the proposed remedies for both soil and groundwater at the Site. Also, an Evaluation of Groundwater Extraction Alternatives is appended in support of the comments.

Upon review of the RI, FS and Proposed Plan, the Group concludes that the proposed soil remedy of excavation and disposal will not achieve the remedial action objective to allow for future site use without restrictions. Furthermore, the proposed remedy is not supported by the administrative record. In contrast, the selection of soil capping as the remedial alternative is supported by the administrative record. In particular, capping is protective of human health and the environment, would satisfy federal and state soil cleanup criteria, is recommended by USEPA guidance, and is consistent with realistic options for any future site use based on development constraints.

¹ The Technical Review of the Remedial Investigation Report was submitted to the United States Environmental Protection Agency ("USEPA") previously on April 9, 1997.

Nigel Robinson
October 10, 1997
Page 2

If the USEPA rejects the recommendation of the Group that capping be selected as the remedial alternative for soils, as supported by these comments, at a minimum, the USEPA should consider a soil remedy composed of selective excavation, a soil cap, and deed restriction. Such a remedy would remove those soils perceived by the community to present a risk, cap soils above federal and state cleanup criteria, and restrict site access to preserve the Site's use as open space. The Group believes that the State of New Jersey and the Township of Piscataway may prefer such a remedy, which would meet their objectives. In particular, by capping the site, the State's PCB criterion would be satisfied. By retaining restrictions on the Site, inappropriate residential use could be avoided, so that future site use would be recreational, as preferred by the Township.

The comments regarding the proposed groundwater remedy, in part, similarly address the inability of the proposed remedy to achieve the remedial action objectives. Specifically, as acknowledged by the FS, geologic and contaminant-related factors indicate that aquifer restoration is highly unlikely at the Site. Consequently, a waiver of ARARs based on the technical impracticability of restoring groundwater should be granted. Because groundwater cannot be restored, the remedial action objective should be to contain contaminated groundwater to protect human health and the environment. Under a containment remedial action objective, extraction geared to achieve mass reduction would result in no additional protection of human health and the environment beyond that provided by a system designed for containment alone. Accordingly, the remedial action objectives should be revised to delete any requirement to restore the groundwater and to remove mass, beyond that removed by containment.

The comments regarding the proposed groundwater remedy also identify several deficiencies in the administrative record that render the proposed remedy unsupported. In particular, because the proposed remedy is based on a "preliminary" groundwater model, the description of the remedy selected in the Record of Decision ("ROD") should permit adequate flexibility to allow the incorporation of the findings of a refined, calibrated groundwater flow model into design of the extraction system, adequate capture zones, the long-term monitoring program, and the off-site delineation investigation.

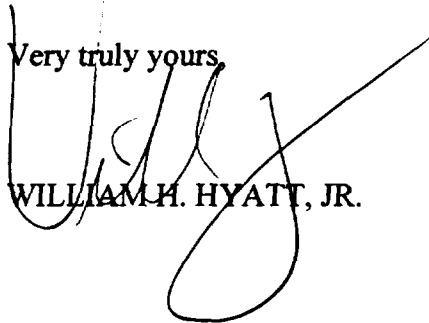
Finally, the comments address certain requirements of the proposed groundwater treatment system. First, the proposed remedy fails to consider the significant discharge constraints presented by the current discharge permits. If the proposed remedy is selected in the ROD, the ROD should provide adequate flexibility in the design of the extraction system to allow for discharge within the existing permit limits. Second, the requirement to operate the biological treatment plant if the treated groundwater is discharged to surface water is unnecessary. In the groundwater treatment plant's current configuration, there have been no exceedences of the surface water discharge standards for soluble organics. In addition, the concentrations of soluble organics in the plant effluent have decreased substantially. Based on

Nigel Robinson
October 10, 1997
Page 3

these factors, as further detailed in the comments, the biological treatment plant does not need to be operated to achieve discharge to surface water standards and the requirement to operate the biological treatment plant should be eliminated.

The Group would be pleased to meet with you to discuss these comments or to provide any assistance required to select an appropriate remedy. Provided the final remedy selection reflects a consideration by USEPA of these comments, the Group, or a significant number of its current members, would expect to offer to perform and pay for that remedy in the context of a negotiated consent decree. We look forward to the opportunity to work with you to implement such a remedy.

Very truly yours,



WILLIAM H. HYATT, JR.

cc: L. Jackson, USEPA (via hand delivery)
P. Seppi, USEPA (via hand delivery)
A. Wagner, USEPA (via hand delivery)
P. Harvey, NJDEP (via overnight delivery)

PITNEY, HARDIN, KIPP & SZUCH

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October 10, 1997

Paul Harvey
New Jersey Department of Environmental Protection
401 East State Street
Trenton, New Jersey 08625

Re: Comments on Remedial Investigation, Feasibility Study
and Proposed Plan
Chemsol, Inc. Superfund Site, Piscataway, New Jersey

Dear Mr. Harvey:

Enclosed is a copy of the comments provided on behalf of the Chemsol PRP Group to the USEPA regarding the above-referenced documents. This copy is being provided directly to you as a courtesy to the NJDEP and the USEPA.

Very truly yours,

WILLIAM H. HYATT, JR.

cc: L. Jackson, USEPA
N. Robinson, USEPA
P. Seppi, USEPA
A. Wagner, USEPA

**COMMENTS ON THE
FEASIBILITY STUDY AND
PROPOSED PLAN**

**CHEMSOL, INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY**

**Prepared on behalf of:
Chemsol Site PRP Group**

September 1997

CONTENTS

1.0	INTRODUCTION	1-1
2.0	COMMENTS REGARDING PROPOSED SOIL REMEDY	2-1
2.1	The remedial action objective to allow for future site use without restrictions cannot be achieved by the proposed soil remedy.	2-1
2.1.1	Because the proposed soil remedy would not achieve the State soil cleanup criteria, it cannot satisfy the remedial action objective to allow for future site use without restrictions.....	2-1
2.1.2	If the remedial action objectives are revised to consider the State soil cleanup criterion, a new remedial alternatives analysis must be performed to comply with the NCP, as a remedial alternative which complies with the State's soil cleanup criterion was not previously evaluated and is expected to result in significantly greater costs and increased risk to human health and the environment.	2-2
2.1.3	The proposed soil remedy cannot satisfy the remedial action objective to allow for future site use without restrictions based on the significant present and anticipated future environmental and physical development constraints located on the Site.	2-3
2.2	The selection of the proposed remedy is not supported by the administrative record. ...	2-4
2.2.1	By requiring the soil be disposed as a hazardous waste, the Proposed Plan proposes a remedy not evaluated by the FS, contrary to the requirements of the NCP.	2-4
2.2.2	Should soil sampling during remedial design reveal a larger volume of soil requiring excavation, the remedy must be re-evaluated as the selection would not be based on all relevant facts, information, and alternatives.	2-5
2.2.3	Stockpiled soils meeting the criteria for backfill should not be required to be disposed of, but should be permitted to be used as backfill.	2-5

2.3	A selection of soil capping as the remedial alternative is supported by the administrative record.	2-6
2.3.1	The Proposed Plan is not consistent with the USEPA guidance on which soil cleanup levels were based; consequently, the remedy selection should be reconsidered as these guidance documents recommend capping for sites with contaminant concentrations at the levels present at the Chemsol site.	2-6
2.3.1.1	The Proposed Plan does not follow USEPA's <i>Guidance on Remedial Actions for Superfund Sites with PCB Contamination</i> which states that, for sites with future residential use scenarios, capping is typically the preferred remedial alternative where PCB concentrations are below 100 ppm.	2-6
2.3.1.2	The lead cleanup standard adopted in the Proposed Plan is not consistent with the procedures set forth in USEPA's <i>Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities</i> , upon which the cleanup standard is purportedly based, and, therefore, the remedy selection should be re-evaluated to conform with the guidance.	2-8
2.3.2	The FS and Proposed Plan overestimate the costs of capping, resulting in an invalid cost comparison of remedial alternatives.	2-9
3.0	COMMENTS REGARDING PROPOSED GROUNDWATER REMEDY	3-1
3.1	Geologic and contaminant-related factors dictate that a Technical Impracticability ARAR waiver should be granted and the remedial action objective be revised accordingly to seek containment of the contaminated groundwater.	3-1
3.2	The remedial action objectives in the Proposed Plan must conform to those in the FS because the remedy selection is based on the screening and evaluation of alternatives presented in the FS.	3-6
3.3	The USEPA uses a "preliminary" groundwater model in its remedy selection, resulting in misinterpretation of key model parameters and, consequently, a remedy selection process based on incomplete and, at times, inaccurate information.	3-7
3.4	The capture zones should be defined by a refined, calibrated groundwater model.	3-13
3.5	Off-site delineation sampling should be limited to the area downgradient of the Site, as defined by the refined groundwater model.	3-14

3.6	The final remedy must consider the significant constraints on the groundwater treatment plant discharge.	3-14
3.7	The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis.	3-15
3.8	A refined, calibrated groundwater model should be used to develop any long-term monitoring program.	3-16
4.0	CONCLUSION	4-1
5.0	REFERENCES	5-1

1.0 INTRODUCTION

A Feasibility Study ("FS"), dated June 1997, was prepared by CDM Federal Programs ("CDM") on behalf of the USEPA for the remediation of contaminated groundwater, soils, surface water and sediments at the Chemsol, Inc. Superfund Site (the "Site" or "Chemsol site"), located in Piscataway, New Jersey. As stated in the FS, the "primary objective of the FS [was] to provide [the United States Environmental Protection Agency ("USEPA") and the New Jersey Department of Environmental Protection "NJDEP"] with sufficient data to select feasible and cost-effective remedial alternatives that protect public health and the environment from potential risks posed by contamination in groundwater, soils, surface water and sediments" at the Chemsol site. Accordingly, the FS included a presentation of the results of the Remedial Investigation ("RI"), as well as an identification, screening, and evaluation of remedial alternatives. Based on the FS, in August 1997, USEPA issued a Proposed Plan for the Chemsol site.

The Proposed Plan recommends preferred alternatives to address soil and groundwater at the Site. The proposed alternative for soil consists of excavating contaminated soil and disposing of it at an approved disposal facility. This alternative was preferred by USEPA over a soil capping alternative, which includes covering the site with a layer of clean soil to prevent contact with contaminated soils. The proposed alternative for groundwater consists of extracting and treating groundwater at an extraction rate in excess of that of the interim remedy. Treated water would be discharged either to the Middlesex County Utilities Authority ("MCUA") or to a nearby stream.

The National Contingency Plan ("NCP") requires the reconsideration of the preferred alternative if:

[a]fter publication of the proposed plan and prior to adoption of the selected remedy in the record of decision . . . new information is made available that significantly changes the basic features of the remedy with respect to scope, performance, or cost, such that the remedy significantly differs from the original proposal in the proposed plan and the supporting analysis. 40 C.F.R. § 300.430(f)(3)(ii).¹

¹ For example, in *United States v. Broderick Investment Co.*, 963 F. Supp. 951, 955 (D. Colo. 1997), the court found that the USEPA had acted arbitrarily and capriciously in failing to properly reconsider the selected remedy when unexpected site conditions arose. In that case, the court found a 61 percent increase in costs should have compelled a re-evaluation of the selected remedy and, in not re-evaluating, the USEPA acted arbitrarily and capriciously. Similarly, the Ninth Circuit held that the agency should have reexamined the remedy selection when the volume of

Further, principles of administrative law require that agency "engage in 'reasoned decisionmaking.'" *United States v. Garner*, 767 F.2d 104, 118 (5th Cir. 1985). Decisions must be "based on a consideration of the relevant factors" and will be reversed for a "clear error in judgment." *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 416 (1971). The agency must not:

rel[y] on factors which Congress has not intended it to consider, entirely fail[] to consider an important aspect of the problem, offer[] an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Motor Vehicle Mfr. Assoc. of the United States, Inc. v. State Farm Mutual Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

Instead, the agency must consider all relevant facts, information and alternatives, *Citizens to Preserve Overton Park, Inc., v. Volpe*, 401 U.S. at 416, comply with its own regulations and procedures,² *Montilla v. Immigration and Naturalization Serv.*, 926 F.2d 162, 166-67 (2d Cir. 1991); *Frisby v. United States Dep't of Housing and Urban Dev. (HUD)*, 755 F.2d 1052, 1055 (3d Cir. 1985), and adequately explain its decisions by providing a rational connection between the facts and the resultant decision. *Sierra Club v. United States Army Corps of Engineers*, 772 F.2d 1043, 1051 (2d Cir. 1985).

Similarly, the Ninth Circuit held that the agency should have reexamined the remedy selection when the volume of hazardous material was underestimated by 160%. *Washington State Dept. of Transportation v. Natural Gas Co.*, 59 F.3d 793, 804 (9th Cir. 1995).

² An agency may not disregard its own rules and regulations during the course of agency decision-making. See, e.g., *Frisby v. United States Dep't of Housing and Urban Dev. (HUD)*, 755 F.2d 1052, 1055 (3d Cir. 1985) ("[T]he agency itself is bound by its own regulations. Failure on the part of the agency to act in compliance with its own regulations is fatal to such action. Such actions are 'not in accordance with law.'"); *Simmons v. Block*, 782 F.2d 1545, 1550 (11th Cir. 1986) and cases cited therein. Moreover, an agency's failure to comply with its own prescribed procedures, including those not attaining the status of formal regulations, has been determined to be arbitrary and capricious. See *Montilla v. Immigration and Naturalization Serv.*, 926 F.2d 162, 166-67 (2d Cir. 1991) (quoting *Morton v. Ruiz*, 415 U.S. 199, 235 (1974); *D'Torio v. County of Delaware*, 592 F.2d 681, 685 n.2 (3d Cir. 1978). Accordingly, when an agency departs from its precedents, the agency must provide a reasoned explanation, in particular why the original reasons for adopting the rule or policy are no longer applicable, or the decision will be vacated as arbitrary and capricious. See *Graphic Communications Int'l Union, Local 554 v. Salem-Gravure Div. of World Color Press, Inc.*, 843 F.2d 1490, 1493 (D.C. Cir. 1988), cert. denied 489 U.S. 1011; *New York Council, Ass'n of Civilian Technicians v. Federal Labor Relations Auth.*, 757 F.2d 502, 508 (2d Cir. 1985), cert. denied 474 U.S. 846.

This document provides comments on behalf of the Chemsol PRP Group³ on the FS and Proposed Plan.⁴ In accordance with the NCP and principles of administrative law, the comments presented below support re-evaluation of certain components of the proposed remedies based on errors in the record and the failure to consider USEPA guidance and certain facts and reconsideration of several remedial objectives to provide for flexibility in the Record of Decision ("ROD") regarding the design of the remedy. Failure to re-evaluate certain components of the proposed remedies or to reconsider the remedial action objectives based on the errors in the FS and Proposed Plan and the information presented herein, which "significantly changes the basic features of the remedy with respect to scope, performance, or cost," would render the USEPA's decision in a subsequent ROD arbitrary and capricious. The comments are summarized below.

Comments on Proposed Soil Remedy

- The remedial action objective to allow for future site use without restriction cannot be achieved by the proposed soil remedy.
 - The FS and the Proposed Plan state that one of the remedial action goals is to address soil contamination so as to allow for unrestricted residential or recreational use of the Site. However, the PCB cleanup criterion of 1 ppm applied by the Proposed Plan does not meet the State's standards. Consequently, even after excavation and disposal of approximately 18,500 cubic yards of soil, a deed restriction, likely with some other control such as capping, would be required by the NJDEP and, therefore, the proposed remedy would not achieve the remedial action objectives.
 - Excavation to the State's criterion has not been analyzed as an alternative. Accordingly, the ROD cannot impose this requirement without performing another remedial alternatives analysis, as excavating to the State's criteria may substantially increase the volume of soil to be excavated, which translates into significantly higher costs and increased risks to human health and the environment, such as risks associated with excavation-related air emissions, truck traffic through residential neighborhoods, and short-term risks to site workers.
 - The current and future physical constraints located on the Site prohibit future site use without restrictions. Wetlands cover a large percentage of the Site, severely limiting the acreage of usable land. Further, the majority of the uplands is located in the vicinity of the groundwater treatment plant. The operation of the plant and the presence of the

³ The Chemsol PRP Group consists of over 40 companies which have constructed and have been operating and maintaining the Interim Remedy at the Site since 1994.

⁴ In addition, more rigorous groundwater modeling simulations are provided as Appendix A to these comments. The simulations use the data presented in the RI and include modeling depicting groundwater flow at the site, presenting several groundwater extraction scenarios by which remedial action objectives can be achieved.

appurtenances associated with the plant further restrict available acreage and ability to develop.

- The selection of the proposed remedy is not supported by the administrative record.
 - Errors in the cost estimating require reconsideration of the appropriateness of the proposed remedy. In particular, the Proposed Plan requires excavated soil to be disposed of as hazardous waste; while the FS assumes disposal as nonhazardous waste. The ROD cannot require disposal as a hazardous waste, because disposal costs will significantly increase beyond those presented in the FS and, in accordance with the NCP and principles of administrative law, the USEPA will have to consider those higher costs prior to remedy selection. However, no representative waste characterization has been performed to determine the RCRA waste classification. Consequently, the ROD should state that disposal requirements will be determined by sampling and analysis conducted during implementation of the remedial action. If, as a result of this sampling and analysis, a majority of the soil is classified as hazardous, the costs will increase substantially and, in accordance with the NCP, the remedy selection will have to be reconsidered.
 - The RI sampling did not adequately define the soil excavation contours. In accordance with the NCP, USEPA must "collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives." 40 C.F.R. § 300.430(d)(1). To this end, USEPA must:

characterize the nature of and threat posed by the hazardous substances and hazardous materials and gather data necessary . . . to support the analysis and design of potential response actions by conducting, as appropriate, field investigations to assess the following factors: . . .(iii) The general characteristics of the waste, including quantities, state, concentration, toxicity, propensity to bioaccumulate, persistence, and mobility; . . .40 C.F.R. § 300.430(d)(2).

Accordingly, the ROD should allow for additional investigation or re-analysis of the data. Further, given the uncertainty in the soil sampling, increases in both excavated volume and remedial cost may occur. Should the volume required to meet the remedial action objectives significantly increase beyond that anticipated in the Proposed Plan, in accordance with the NCP and principles of administrative law, the USEPA will have to reconsider the remedy selection.

- The FS and Proposed Plan require disposal of soils stockpiled on Site. However, if analysis demonstrates that these soils comply with New Jersey soil cleanup criteria, the ROD should permit these soils to be used as backfill if demonstrated to be acceptable for that purpose.

- The selection of soil capping as the remedial alternative is supported by the administrative record, as it is protective of human health and the environment, complies with ARARs, is recommended by USEPA guidance, and is consistent with realistic options for any future site use.
 - The proposed soil cleanup standards are not supported by the guidance referenced as their source, and no further explanation is provided to support the selection of the cleanup standards. Moreover, the guidance documents referenced do not support the selection of the remedial alternative. These guidance documents acknowledge the appropriateness of capping for sites with contamination at the levels present at the Chemsol site. Because no reason for departing from the guidance purportedly relied upon is provided, the soil cleanup goals and remedy must be re-evaluated based on the guidance. Moreover, consistent with the guidance, capping should be the selected remedy in the ROD.
 - Errors in the cost estimating for soil capping require reconsideration of the appropriateness of the proposed remedy. These errors overestimate the extent of the remedial action and cost for soil cover. Also, the cost estimate arbitrarily assumes stockpiled soils cannot be used as soil cover. As detailed herein, because the cost estimate for the capping alternative is grossly overestimated, the selection of the proposed remedy is based on faulty assumptions regarding the costs of the remedial alternatives. Consequently, there has not been a valid cost comparison of the remedial alternatives as required by the NCP and, therefore, the remedy selection must be re-evaluated.

Comments on Proposed Groundwater Remedy

- As recognized in the FS and various USEPA guidance documents, there is a high degree of certainty that aquifer restoration and significant mass reduction cannot be achieved at the Chemsol site based on hydrogeologic and contamination-related factors, specifically the presence of DNAPL in fractured bedrock. Consequently, the ROD should waive ARARs for groundwater restoration based on the technical impracticability of restoring the aquifer. 40 C.F.R. § 300.430(f)(1)(ii)(C)(3). Moreover, the ROD should not require extraction of groundwater to achieve mass reduction, to the extent it can be achieved at all, because it will provide no additional protection of human health and the environment. The remedial action objectives should be revised to require hydraulic containment of the groundwater plume.
- The groundwater flow model used in the FS, which forms the basis for the selection of the remedy in the Proposed Plan, is described as “preliminary” because of a limited calibration and the existence of data gaps. The preliminary groundwater flow model should not have been used for predictive purposes. Consequently, the ROD should embrace the recommendations set forth in the groundwater modeling report which state, “[T]he model should be upgraded from ‘preliminary’ status to ‘predictive’ status by resolving data gaps and uncertainties and performing additional calibration.” Because the preliminary model is based

on inadequate and, at times, inaccurate data, the ROD must be written in such a manner to allow for the incorporation of the findings of a refined, calibrated groundwater model into the design of the groundwater extraction system, including the number of extraction wells, the well locations, the well extraction rates, and the aggregate extraction rate.

- The proposed alternative requires pumping from all groundwater zones up to a saturation depth of approximately 375 feet. No justification is provided for requiring extraction of certain uncontaminated portions of the aquifer, either on-site or beyond the Site boundaries. The agency has defined the extraction boundaries based on only a preliminary groundwater model. The ROD should not specify the extent of the capture zone; rather, the capture zone should be identified as the contaminated area defined by the RI, and any additional investigations conducted as part of remedial design, and be determined using a refined, calibrated groundwater model.
- Off-site groundwater plume delineation should be limited to the downgradient area of the Site. Further, the definition of the downgradient area should be determined using a refined, calibrated groundwater model.
- The existing MCUA permit and NJDEP surface water discharge permit equivalent present significant constraints on the effluent discharge, as they are based on a discharge flow rate of 30 gpm. These discharge limitations are not considered in the evaluation of the remedial alternatives. By failing to do so, the agency has entirely failed to consider an important aspect of the problem. Due to this oversight, the ROD must be written to permit flexibility in the extraction system design to conform to these limitations.
- There is no technical basis for the requirement in the FS and Proposed Plan to operate the biological treatment plant if the treatment plant effluent is discharged to surface water. Currently, the plant effluent discharged to the MCUA would exceed surface water discharge standards for only barium, manganese and total dissolved solids ("TDS"). In its current configuration, there have been no exceedences for soluble organics. Operation of the biological treatment plant will not assist in reaching the standards for those criteria exceeded. Moreover, the influent concentrations of soluble organics have decreased significantly. Accordingly, the requirement of operating the biological treatment plant should not be an explicit element of the selected alternative in the ROD.
- A refined, calibrated groundwater model should be used to structure any long-term monitoring program, including the number and location of wells to be sampled. Similarly, the long-term monitoring sampling parameters should be developed during remedial design based on site contaminants.

2.0 COMMENTS REGARDING PROPOSED SOIL REMEDY

2.1 The remedial action objective to allow for future site use without restrictions cannot be achieved by the proposed soil remedy.

2.1.1 Because the proposed soil remedy would not achieve the State soil cleanup criteria, it cannot satisfy the remedial action objective to allow for future site use without restrictions.

Two of the remedial action objectives for soil remediation are in direct conflict and require revision by the USEPA. These objectives are:

- restoring the soil at the Site to levels which will allow for residential/recreational use (without restrictions); and
- prevent human exposure to surface soils contaminated with PCB concentrations above 1 part per million (ppm) and lead concentrations above 400 ppm.

The Proposed Plan's goal of "restoring the soil at the Site to levels which would allow for residential/recreational use (without restrictions)" apparently ignores the fact that by not remediating to New Jersey's soil cleanup standard, future Site use would continue to be subject to restrictions. As the USEPA recognized in the Proposed Plan, the State of New Jersey has developed a state-wide soil cleanup criterion for PCBs of 0.49 ppm. (USEPA, 1997b) The USEPA further recognized that, "if the remedy does not achieve the State [criterion], the State will require that restrictions be placed on the property to prevent future direct contact with soils above 0.49 ppm." (USEPA, 1997b) Indeed, "the State of New Jersey cannot concur on the preferred remedy unless its soil direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria." (USEPA, 1997b) Consequently, even after excavation and disposal of approximately 18,500 cubic yards of soil at an estimated cost of \$5.5 million, the Proposed Plan acknowledges that a deed restriction, and possibly other institutional controls or engineering controls, such as a cap, would still be required by the NJDEP. The remedial action objective to allow for future site use without restrictions cannot be achieved under these circumstances.

To remedy this error, the USEPA should delete the "without restrictions" requirement in the remedial action objective so it is revised to read:

- restoring the soil at the Site to levels which will allow for residential/recreational use.

2.1.2 If the remedial action objectives are revised to consider the State soil cleanup criterion, a new remedial alternatives analysis must be performed to comply with the NCP, as a remedial alternative which complies with the State's soil cleanup criterion was not previously evaluated and is expected to result in significantly greater costs and increased risk to human health and the environment.

The proposed remedial alternative of excavation and disposal of contaminated soils will have to be revised to achieve the State soil cleanup criterion if the remedial action objective of unrestricted future use of the property is to be achieved. If additional excavation is to be considered to achieve the State criterion, the remedy selection would have to be re-evaluated as it is not evaluated by the FS or Proposed Plan.

The additional excavation work required to achieve the New Jersey criterion is likely to be significant. The proposed remedy addresses only surface (0-2 feet) soil. (USEPA, 1997a) Based on the analytical results presented in the RI, some areas of the Site may require up to six (6) feet of excavation to meet the New Jersey criterion. (USEPA, 1996) The RI data indicate that additional excavation volumes could be more than 25% greater than USEPA estimates, depending on the vertical distribution of soil constituents at the Site. (Affidavit of Willard F. Potter dated October 10, 1997 [hereinafter, "Potter Affidavit"]) As a result, if the remedy is altered to meet this goal, significant costs and increased risks to human and health and the environment would ensue.

Depending on the classification of the excavated soil for off-site disposal (*see* Section 2.7), the actual cost of the proposed remedy could increase to \$6.7 million up to \$18.4 million. (Potter Affidavit) Should costs increase, review by the National Remedy Review Board may be required as the estimated cost of the proposed remedy would be expected to exceed \$10 million and, if so, would be 50% greater than the least costly, protective, ARAR-compliant alternative.

Furthermore, increased risks would result from any additional excavation. In particular, the additional excavation would result in larger volumes for excavation, which translates into proportionately higher truck traffic through residential neighborhoods and on the roads and highways, increased potential for excavation-related air emissions, and greater short term risks to site workers.

Because the additional excavation would significantly increase costs, resulting in this alternative being materially different from the proposed remedy, a new remedial alternatives analysis would have to be performed before the ROD is issued to satisfy the requirements of the NCP.

2.1.3 The proposed soil remedy cannot satisfy the remedial action objective to allow for future site use without restrictions based on the significant present and anticipated future environmental and physical development constraints located on the Site.

The remedial action objective to “restore the soil at the Site to levels which will allow for residential/recreational use (without restrictions)” cannot be achieved due to development restrictions posed by the presence of wetlands and the groundwater treatment facility on Site.

Wetlands cover a large percentage of the Site. (USEPA, 1997a (Figure 1-31); USEPA, 1996) Indeed, only approximately three (3) to four (4) acres will be available for use without causing impact to the designated onsite wetlands. (USEPA, 1997a; USEPA, 1996) This fact is not considered by the FS or Proposed Plan in the analysis of the alternatives. Furthermore, no cost for mitigation of wetlands disturbed by the proposed soil remedy has been considered.

Moreover, the majority of the uplands is located in the vicinity of the groundwater treatment plant. (USEPA, 1996) Consequently, any development would be restricted to a relatively small area in the vicinity of the groundwater treatment plant. However, the appurtenances associated with the plant, such as underground lines, extraction wells, and monitoring wells, would further reduce the acreage available for development and would restrict the type of development. In fact, the presence and operation of the groundwater treatment plant may entirely preclude any development or site use until the groundwater remedial action is complete.

In consideration of these significant constraints on development, the “without restrictions” requirement should be deleted from the remedial action objective, so it is revised to read:

- restoring the soil at the Site to levels which will allow for residential/recreational use.

2.2 The selection of the proposed remedy is not supported by the administrative record.

2.2.1 By requiring the soil be disposed as a hazardous waste, the Proposed Plan proposes a remedy not evaluated by the FS, contrary to the requirements of the NCP.

The Proposed Plan states that the excavated soil "would be disposed at a facility which is licensed under RCRA to accept hazardous waste." (USEPA, 1997b) This statement is inconsistent with the conclusions reached in the RI that were adopted by the FS. (USEPA, 1996; USEPA, 1997a) In fact, disposal at a hazardous waste landfill would result in the FS cost estimate being grossly understated. (Potter Affidavit) The RI/FS Guidance states that FS cost estimates "are expected to provide an accuracy of +50 percent to -30% and are prepared using data available from the RI." (USEPA, 1988) Requiring disposal as a hazardous waste results in the estimated cost for the proposed alternative being underestimated by more than \$9.1 million (Potter Affidavit), well beyond the accepted cost estimating tolerance prescribed in USEPA guidance. (USEPA, 1988)

The excavated soil transportation and disposal costs for a RCRA landfill can be more than four (4) times higher than the comparable costs for nonhazardous soils used in the FS. (Potter Affidavit) The estimated cost for the excavation and disposal alternative may increase by as much as \$9 million, for a total estimated cost of over \$14.5 million. (Potter Affidavit) Consequently, the ROD cannot require disposal as a hazardous waste as, in accordance with the NCP and principles of administrative law, the USEPA would have to consider those higher costs prior to such a remedy selection.

However, none of the samples analyzed for hazardous characteristics by the TCLP testing procedures specified at 40 C.F.R. § 261.24 are within the extent of the proposed excavation. While none of soil samples leached hazardous constituents in excess of the RCRA hazardous waste criteria, because none are in the within the extent of excavation, the RI's conclusion that the soil is nonhazardous is unsupported.

The ROD should state that the soil disposal facility will be determined by soil sampling and classification conducted during the implementation of the selected remedy. However, if a majority of the soil is classified as hazardous, and the costs increase substantially, the remedy selection in the ROD would have to be re-evaluated in accordance with the NCP.

2.2.2 Should soil sampling during remedial design reveal a larger volume of soil requiring excavation, the remedy must be re-evaluated as the selection would not be based on all relevant facts, information, and alternatives.

If the USEPA retains the proposed remedy of excavation and disposal of soil, the ROD should be written to allow additional soil sampling during the remedial design to determine more accurately the volume of material that is required to be excavated. Neither the PCB contamination contours nor the lead contamination contours are well-defined by the RI sampling. For example, the lead contamination contours are based on only three soil borings. (USEPA, 1997a) Moreover, the areas to be excavated appear to include sediments near the confluence of the Northern Ditch and Stream IB. The Proposed Plan determines remediation of these sediments is not warranted at this time. (USEPA, 1997b)

However, as a result of this additional delineation, significantly greater quantities of soils may be identified as requiring excavation and disposal under the Proposed Plan, thereby greatly increasing cost. If the volumes significantly increase, the assumptions in the Proposed Plan would be materially incorrect and the NCP will compel reconsideration of the remedy selection. 40 C.F.R. § 300.435(c)(2).

2.2.3 Stockpiled soils meeting the criteria for backfill should not be required to be disposed of, but should be permitted to be used as backfill.

The Proposed Plan requires that the soil presently stockpiled on-site be disposed of off-site. However, the requirement for off-site disposal presently is confirmed only for the soils excavated in connection with the removal of the underground storage tank. (USEPA, 1997a (Appendix C)) The other two soil stockpiles were excavated from the area in the vicinity of the groundwater treatment plant building, which area is believed not to be contaminated. The RI sampling supports this conclusion, as samples collected in the vicinity of the treatment plant do not exhibit contamination above the cleanup standards set forth in the Proposed Plan. (USEPA, 1996) If sampling confirms that these soils do not contain contaminants above the New Jersey soil cleanup criteria, the ROD should permit the use of these soils as acceptable backfill or cover material.

2.3 A selection of soil capping as the remedial alternative is supported by the administrative record.

In accordance with USEPA guidance, the FS states that, based on its proposed future use, capping is an appropriate remedial action for the levels of contamination present at the Chemsol site. (USEPA, 1997a) The Proposed Plan assumes that the most probable future use of the site would be for residential or recreational purposes, stating that the municipality has expressed a preference for recreation use for the property. (USEPA, 1997b) As discussed in Section 2.3.1, USEPA Guidance expressly recommends capping for residential-use sites with contamination levels equivalent to those detected at the Chemsol site. (USEPA, 1994b; USEPA, 1990) Further, for the Chemsol Site, the FS states that capping will allow for "many residential type uses of the property, such as for recreational purposes as a park or a playground among others." (USEPA, 1997a)

Capping is protective of human health and the environment, recommended by USEPA guidance, and consistent with realistic options for any future site use based on site development constraints. Further, capping would satisfy not only the cleanup levels set forth in the Proposed Plan, but also would satisfy the State PCB cleanup criterion. The proposed remedy should be re-evaluated in consideration of these significant facts, as soil capping is supported by the administrative record.

2.3.1 The Proposed Plan is not consistent with the USEPA guidance on which soil cleanup levels were based; consequently, the remedy selection should be reconsidered as these guidance documents recommend capping for sites with contaminant concentrations at the levels present at the Chemsol site.

2.3.1.1 The Proposed Plan does not follow USEPA's *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* which states that, for sites with future residential use scenarios, capping is typically the preferred remedial alternative where PCB concentrations are below 100 ppm.

In the Proposed Plan, USEPA states, "Soil cleanup levels for PCBs at the Site were obtained from EPA's 1990 'Guidance on Remedial Actions for Superfund Sites with PCB Contamination.'" (USEPA, 1997b) This guidance, in part, "summarizes the primary considerations associated with determining the appropriate response action for a PCB contaminated Superfund site in terms of the nine evaluation criteria used in the detailed analysis." (USEPA, 1990) In doing so, the guidance provides USEPA's interpretation of the requirements of the NCP at Superfund sites with PCB contamination. However, without

explanation, the Proposed Plan did not follow the guidance and, correspondingly, did not satisfy the requirements of the NCP.

In the guidance, USEPA acknowledges that a cap is the preferred remedial alternative for sites where only "low-threat" concentrations of PCBs are present. The guidance recognizes an action level of 1 ppm for sites with unlimited exposure under residential land use scenarios; however, this 1 ppm standard is a "starting point action level," not a cleanup standard. (USEPA, 1990) Instead, the guidance requires that final cleanup levels reflect all relevant exposure pathways and be defensible on a site-specific basis. (USEPA, 1990)

According to the guidance, the expectation of the Superfund program that "principal threats at a site will be treated wherever practicable and that low-threat material will be contained and managed" should be followed in determining an appropriate cleanup standard and remedial action for a Site. (USEPA, 1990) The guidance defines principal threats to include "soil contaminated at 2 to 3 orders of magnitude above the [1 ppm] action level," or "[f]or sites in residential areas, . . . soil contaminated at concentrations exceeding 100 ppm PCBs." (USEPA, 1990) The guidance states that material above action levels not constituting a principal threat (less than 100 ppm for residential areas) should be "contained to prevent access." (emphasis added) (USEPA, 1990) Moreover, "where low concentrations of PCBs will remain on site and direct contact risks can be reduced sufficiently, minimal long term management controls are warranted." (USEPA, 1990) The USEPA estimates that a ten (10) inch soil cover will reduce risks by approximately one order of magnitude. (USEPA, 1990) Accordingly, the PCB Spill Cleanup Policy recommends a 10 ppm cleanup level with a 10 inch cover for residential areas. 40 C.F.R. § 761.125(c)(4)(v).

Based on the detected PCB concentrations at the Chemsol site, the guidance recommends capping as the preferred remedial alternative. For surface soils, PCBs are detected below 5 ppm in 73% of the screening samples from the RI, while PCBs are detected below 5 ppm in 84% of the laboratory-analyzed samples. (USEPA, 1996) For subsurface soils, PCBs are detected below 5 ppm in 90% of the screening samples, while PCBs are detected below 5 ppm in 98% of the laboratory-analyzed samples. (USEPA, 1996) Only one laboratory-analyzed sample detected PCBs in excess of 50 ppm, while the geometric mean of all laboratory-analyzed samples is 0.099 ppm (0.177 ppm for surface soils). (USEPA, 1996) The Proposed Plan fails to apply the guidance to these data and, therefore, fails to comply with USEPA's interpretation of the requirements of the NCP at Superfund sites with PCB contamination. As a result, the proposed

alternative should be re-evaluated to conform with the USEPA guidance. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

2.3.1.2 The lead cleanup standard adopted in the Proposed Plan is not consistent with the procedures set forth in USEPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, upon which the cleanup standard is purportedly based, and, therefore, the remedy selection should be re-evaluated to conform with the guidance.

The Proposed Plan states, "The 400 ppm lead cleanup level is based on EPA's 1994 'Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.'" (USEPA, 1997b) The guidance, in part, "establishes a streamlined approach for determining protective levels for lead in soil at CERCLA Sites," thereby providing USEPA's interpretation of the requirements of the NCP at Superfund sites with lead contamination in soils. (USEPA, 1994b) Similar to the PCB guidance, the Proposed Plan, without explanation, does not follow the guidance and, correspondingly, does not satisfy the requirements of the NCP.

The guidance recommends using 400 ppm as a screening level for lead in soil at residential sites. However, the guidance specifically states:

Screening levels are not cleanup goals. Levels of contamination above the screening level would NOT automatically require a removal action, nor designate a site as 'contaminated.'" (emphasis in original) (USEPA, 1994b)

In fact, residential preliminary remediation goals of "more than twice the screening level have been identified," and "[a]fter considering other factors such as costs of remedial options, reliability of institutional controls, technical feasibility, and/or community acceptance, still higher cleanup levels may be selected." (USEPA, 1994b) No such analysis has been performed for the Chemsol site. Indeed, no justification for the selection of the cleanup goals has been provided.

Moreover, the guidance goes on to state that exceedence of an appropriate cleanup standard does not necessarily require excavating soil. Instead, intervention measures (e.g., capping, institutional controls) may be more appropriate than excavation at many sites.⁵ (USEPA, 1994b)

⁵ The TSCA Section 403 Guidance suggests limited interim controls at sites with lead concentrations in the range of 400 ppm to 5000 ppm.

The Proposed Plan fails to consider the guidance correctly and, therefore fails to comply with the USEPA's interpretation of the requirements of the NCP at Superfund Sites with lead contamination. As a result, if the proposed alternative should be re-evaluated to conform with the USEPA guidance. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

2.3.2 The FS and Proposed Plan overestimate the costs of capping, resulting in an invalid cost comparison of remedial alternatives.

The cost for the capping alternative is overestimated by up to \$1.15 million, which is 60% of the cost presented in the FS and relied upon by the Proposed Plan. (Potter Affidavit) The RI/FS Guidance states that FS cost estimates "are expected to provide an accuracy of +50 percent to -30% and are prepared using data available from the RI." (USEPA, 1988) However, as detailed below, the cost estimate for the capping alternative misinterprets the data generated as part of the RI and, as a consequence, overestimates the costs beyond the tolerances acceptable to USEPA. These errors in the cost estimating dictate that the proposed remedy must be reconsidered as there has not been a valid cost comparison of remedial alternatives as required by the NCP. Moreover, because the costs for the capping alternative are significantly lower than estimated by the FS, the proposed alternative becomes significantly more expensive without a corresponding increase in protection of human health and the environment.

The unit cost for soil cover in the capping alternative exceeds the unit cost for backfill under the excavation alternative by \$10.67 per cubic yard. (USEPA, 1997a) The record states no reason, nor is there any justifiable reason, why more expensive soils/backfill would be required for the capping alternative. In fact, the FS requires that "clean common fill . . . satisfy[ing] New Jersey soil cleanup criteria for residential use" be used for both alternatives. (USEPA, 1997a) Consequently, the estimated cost for capping of 12 acres is overstated by over \$0.4 million (including multipliers). (Potter Affidavit)

In addition, the FS and Proposed Plan state that 5.73 acres would be disturbed by excavation, while 12 acres would have to be capped. Again, the record contains no explanation or justification for this difference. The areal extent of soil exceeding cleanup levels is defined by the excavation alternative to be 5.73 acres; there is no reason to require a soil cap for any area not presenting an alleged risk. Further, constructing a soil cap over 12 acres would impact on-site wetlands. No cost for mitigation of the impacted wetlands is included in the FS cost estimate. Using the correct unit cost for soil cover, without even considering the cost for mitigation of any

impacted wetlands, the cost for constructing the capping alternative is overstated by over \$0.9 million. (Potter Affidavit) Therefore, the more accurate cost estimate for the capping alternative is \$959,938, as compared to the FS estimate of \$1,894,275.

Furthermore, if analytical results of the stockpiled soil demonstrate that the soil is acceptable for use as cover material (*i.e.*, meets the New Jersey soil cleanup criteria), the total cost of the capping alternative (including capping and disposal of drums and stockpiled soil) is reduced by an estimated additional \$216,000, for a total reduction of \$1.15 million. (Potter Affidavit)

3.0 COMMENTS REGARDING PROPOSED GROUNDWATER REMEDY

3.1 Geologic and contaminant-related factors dictate that a Technical Impracticability ARAR waiver should be granted and the remedial action objective be revised accordingly to seek containment of the contaminated groundwater.

USEPA guidance and extensive experience demonstrate that two of the groundwater remedial action objectives in the Proposed Plan are unachievable based on the hydrogeologic conditions and contamination present at the Chemsol site. The groundwater remedial objectives in the Proposed Plan seek, in part, to "remove and treat as much contamination as possible from the fractured bedrock." and to "restore remaining affected groundwater to State and federal drinking water standards." (USEPA, 1997b) However, based on the investigations conducted during the RI, dense, nonaqueous phase liquid ("DNAPL") is present across the site in fractured bedrock. (USEPA, 1996) The FS expressly acknowledges that "[a]quifer restoration is highly unlikely in this fractured bedrock." (USEPA, 1997a) Accordingly, an ARAR waiver, based on the technical impracticability of restoring groundwater, should be granted. 40 C.F.R. § 300.430(f)(1)(ii)(C)(3). Moreover, in conformance with the NCP, USEPA guidance, and the FS remedial action objectives, the remedial action objectives for groundwater remediation at the Chemsol site should be revised correspondingly to seek only hydraulic containment of the groundwater plume. Extraction for mass reduction has little, if any, utility because groundwater ARARs are impossible to achieve in a reasonable timeframe.

When DNAPL is present in a fractured rock media, little in the way of meaningful groundwater restoration can be accomplished through efforts to remove contaminant mass by groundwater extraction. (USEPA, 1993) In summary, the science has demonstrated over the years that removal of DNAPL in fractured bedrock is complicated by inaccessibility (e.g., in dead-end fractures in bedrock), flow mechanics independent of groundwater flow, complex flow patterns, and difficulties in locating DNAPL accumulations. (Parker, Gillham and Cherry, 1994) USEPA recognizes these difficulties in its various guidance documents, including the *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration*, OSWER Directive 9234.2-25 (September 1993) ("TI Guidance"). Indeed, it has been demonstrated time and again that attempts of any kind to remove contaminant mass in the conditions present at the Chemsol site would be futile. (Parker, Gillham and Cherry, 1994) Accordingly, the currently accepted practice under these conditions is to contain groundwater to protect downgradient receptors. (Parker, Gillham and Cherry, 1994; *see also* USEPA, 1993)

The RI concludes that DNAPL exists in numerous overburden and bedrock wells at the Chemsol site. (USEPA, 1996) This conclusion is based primarily on a comparison of groundwater quality data to constituent solubilities, the methodology described in *Estimating Potential for Occurrence of DNAPL at Superfund Sites* (USEPA, 1992).⁶ USEPA guidance identifies "concentrations of DNAPL-related chemicals in groundwater [that] are greater than 1% of pure phase solubility or effective solubility" as a condition indicating the potential for DNAPL. (USEPA, 1992) For example, historical groundwater quality data for monitoring well C-1 at the Chemsol site indicate that trichloroethene was present in concentrations in excess of 20% of its solubility, clearly demonstrating the presence of DNAPL. (USEPA, 1991) The RI provides additional evidence of the presence of DNAPL in that material resembling "tar balls" has been observed during maintenance of the groundwater extraction system. (USEPA, 1996)

The importance of the presence of DNAPL in the remediation of contaminated sites has been recognized since the early 1980s. (Freeze and Cherry, 1979) More recently, the USEPA has acknowledged the problems presented by the presence of DNAPL:

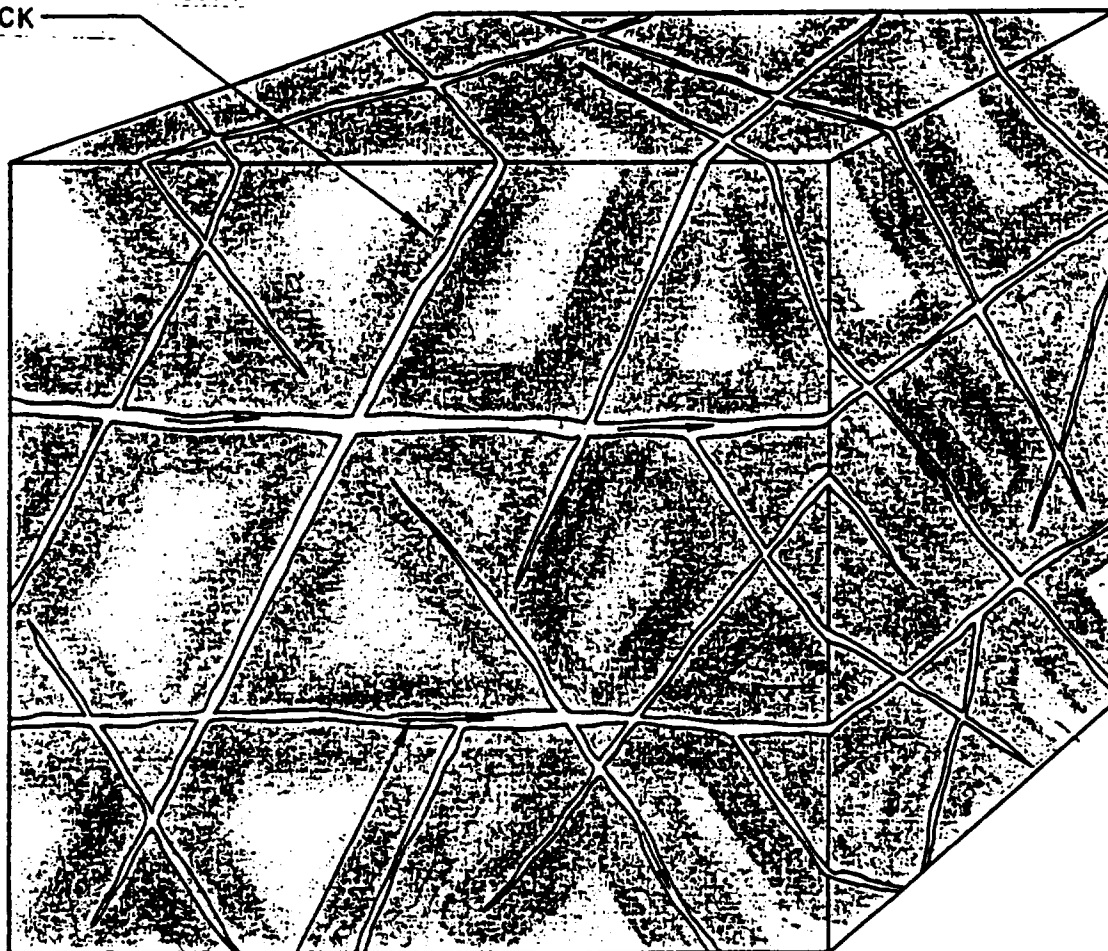
Once in the subsurface, it is difficult or impossible to recover all of the trapped residual DNAPL. The conventional aquifer remediation approach, groundwater pump-and-treat, usually removes only a small fraction of trapped residual DNAPL. Although many DNAPL removal technologies are currently being tested, to date there have been no field demonstrations where sufficient DNAPL has been successfully recovered from the subsurface to return the aquifer to drinking water quality. (USEPA, 1992)

The presence of DNAPL contamination within the rock matrix itself is of particular importance to the ability to achieve groundwater restoration within a *reasonable* time frame.⁷ The entrance to and eventual release of contaminants from the rock matrix are diffusion controlled processes. (Parker, Gillham and Cherry, 1994) As contaminated groundwater moves through the fractures of a bedrock aquifer, diffusion of contaminants will occur into the essentially stagnant matrix pore water of the rock, as illustrated in Figure 3-1. (Parker, Gillham and Cherry, 1994) The extent of the diffusion and its hydrogeologic significance will depend upon the concentration

⁶ The fact that analyses conducted during the RI of rock core samples by ultraviolet fluorescence did not identify NAPL is not surprising given the fact that chlorinated organics typically do not fluoresce.

⁷ USEPA (1993) has used a time period of 100 years or more in its discussions regarding what constitutes a reasonable time frame for aquifer restoration.

CONTAMINANT DIFFUSION
INTO MATRIX POROSITY
OF ROCK



CONTAMINANTS IN FLOWING
GROUNDWATER WITHIN
FRACTURE

10.0140

FIGURE 3-1

MATRIX DIFFUSION IN FRACTURED ROCK AQUIFERS

CHEMSOL SUPERFUND SITE
PISCATAWAY, NEW JERSEY

SOURCE: MUTCH, R.D. AND SCOTT, J.I. (1993)

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey

gradient, the matrix diffusivity and porosity, the fracture spacing of the rock, and the duration of exposure. (Parker, Gillham and Cherry, 1994)

The diffusion of contaminants into the rock matrix can be considered beneficial in that it retards the advance of a contaminant plume through the fractured rock. (Lever and Bradbury, 1985) However, when the objective is to purge contamination from an aquifer, the diffusion-controlled release of contaminants from the rock matrix can greatly prolong aquifer cleanup efforts over what would be possible in a simple porous medium of equivalent hydraulic conductivity. Consequently, contaminants in the rock matrix become a long-term source of groundwater contamination for which there is no remedial measure currently available. (USEPA, 1993) One would expect groundwater remediation time within rock aquifers contaminated with DNAPL chemicals to be measured in hundreds of years. (USEPA, 1993) The failure to discuss adequately the significance of DNAPLs and matrix diffusion as they relate to overall site remediation is a fatal flaw in the FS.

Furthermore, the significance of matrix diffusion to groundwater restoration is not limited to the DNAPL zone. In fact, the diffusion process will play a similar role in substantially delaying the removal of mass in the area of the aqueous plume downgradient of the DNAPL zone. (USEPA, 1993) USEPA has also acknowledged the significance of this phenomenon:

EPA recognizes, however, that there are technical limitations to ground-water remediation technologies unrelated to the presence of a DNAPL source zone. These limitations, which include contaminant-related factors (e.g., slow desorption of contaminants from aquifer materials) and hydrogeologic factors (e.g., heterogeneity of soil or rock properties), should be considered when evaluating the technical practicability of restoring the aqueous plume. (USEPA, 1993)

In the TI Guidance, the USEPA recognizes the foregoing and states that hydrogeologic and contaminant-related factors can inhibit groundwater restoration. The TI Guidance further states that the presence of fractured bedrock and DNAPL "makes extraction or *in-situ* treatment of contaminated groundwater extremely difficult," specifically noting that DNAPL "generally is not capable of migrating or being displaced by normal groundwater flow." (USEPA, 1993)

A front-end TI decision is appropriate where "adequate site characterization data [is] present[] to demonstrate, not only that [a known remediation] constraint exists, but that the effect of the

constraint on contamination distribution and recovery potential poses a critical limitation to the effectiveness of available technologies.” (USEPA, 1993) Based on the groundwater characterization conducted during the RI and the groundwater model presented in Appendix A, the site has been characterized adequately to support a TI decision.

The TI guidance provides:

[C]ertain types of source contamination are resistant to extraction . . . and can continue to dissolve slowly into ground water for indefinite periods of time. Examples of this type of source constraint include certain occurrences of NAPLs, such as where the quantity, distribution, or properties of the NAPL render its removal from, or destruction within, the subsurface infeasible or inordinately costly. (USEPA, 1993)

Furthermore,

Geologic constraints . . . also may critically limit the ability to restore an aquifer. . . . Some geologic constraints, however, may be defined sufficiently during site characterization so that their impacts on restoration potential are known with a relatively high degree of certainty. An example of this type of constraint includes complex fracturing of bedrock aquifers, which makes recovery of contaminated ground water or DNAPLs extremely difficult. (USEPA, 1993)

The RI concludes that indications of DNAPL are present in at least 23 wells on the Chemsol site. (USEPA, 1996) In addition, fractured bedrock is present across the Site. (USEPA, 1996) Based on the presence of DNAPL in fractured bedrock, a front-end TI decision is appropriate for the Site.

The NCP requires restoration of groundwater only “wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site.” 40 C.F.R. § 300.430(a)(1)(iii)(F). USEPA has determined 100 years to be a “very long restoration timeframe.” (USEPA, 1993) The USEPA acknowledges that “[DNAPL] compounds . . . are often very difficult to locate and remove from the subsurface environment and may continue to contaminate ground water for *many hundreds of years* despite best efforts to remediate them.” (emphasis added) (USEPA, 1993) USEPA concludes that “in cases where there is a high degree of certainty that cleanup levels cannot be achieved, a final ROD that invokes a TI ARAR waiver and establishes an

alternative remedial strategy may be the most appropriate option.” (USEPA, 1993) “Where it is technically impracticable to remove subsurface DNAPLs, EPA expects to contain the DNAPL zone to minimize further release of contaminants to the surrounding ground water, wherever practicable.” (USEPA, 1993)

Similarly, in the USEPA’s Superfund Administrative Reforms, USEPA has promoted updating remedy decisions where “significant new scientific information or technological advancement will achieve the same level of protectiveness.” (USEPA, 1995) In particular:

By the 1990s, experience indicated that sites contaminated with [DNAPLs] could require an inordinate amount of time to restore the ground water to drinking water levels using conventional pump and treat technology alone. . . . [C]urrent policy is to isolate and contain the DNAPL source, removing the source only to the degree practicable. (USEPA, 1995)

Based on the hydrogeologic and contaminant factors at the Chemsol site, there is a high degree of certainty that the attainment of the remedial action objectives in the Proposed Plan is not technically practicable. As discussed above, both the USEPA and experts recognize that the use of groundwater extraction for the purpose of contaminant mass removal has little overall effect on groundwater quality under the geologic and contaminant conditions present at the Chemsol site. Specifically, because of the presence of DNAPL in fractured bedrock, groundwater restoration cannot be achieved at the Chemsol site, particularly within a reasonable timeframe. Consequently, a TI ARAR waiver should be granted.

Because groundwater restoration is not achievable at the Site, the remedial action objective should be revised, in conformity with the objective set forth in the FS, to seek the containment of the groundwater. References in the remedial action objectives to groundwater restoration and/or mass removal should be removed. Because groundwater cannot be restored, mass reduction pumping is unnecessary. Accordingly, the remedial action objective should be revised, as follows:

- prevent migration of the contaminated groundwater in the fractured bedrock aquifer; augment the existing groundwater system to contain the contaminated groundwater from all depth zones.

Even if USEPA were not to grant a TI waiver or revise the remedial action objectives, groundwater pumping scenarios should be optimized to achieve containment of the groundwater rather than to be geared toward mass reduction, as it is the hydraulic containment that will serve to protect human health and the environment. An extraction system that contains the groundwater will prevent downgradient migration and, thereby, protect human health and the environment by eliminating the contributing source. Based on the presence of fractured bedrock and DNAPL, the potential for achieving additional significant mass reduction at this Site beyond that provided by containment is extremely low. The goal to achieve mass reduction should not dictate the location of extraction wells. As groundwater extraction will not stimulate matrix diffusion, and may actually decrease the diffusion of contaminants into groundwater, a source reduction pumping scheme is no more effective in providing mass reduction than the recommended containment scheme. (National Research Council, 1994)

3.2 The remedial action objectives in the Proposed Plan must conform to those in the FS because the remedy selection is based on the screening and evaluation of alternatives presented in the FS.

It is erroneous for the Proposed Plan to rely on the remedial alternatives analysis conducted in the FS, but alter the remedial action objectives. The entire FS remedy evaluation, from the screening to the detailed evaluation, relies on the remedial action objectives set forth in the FS. The Proposed Plan cannot arbitrarily change these objectives, but rely on the analysis.

In particular, the remedial action objectives in the FS seek to:

- Prevent/minimize offsite migration of groundwater contamination in the fractured bedrock aquifer. Contain the contaminated groundwater (that is above Federal and State MCLs) from all depth zones and, as an element of this containment, reduce the mass of contaminants to the maximum extent possible. Augment the existing interim remedy as necessary, in order to achieve these goals. Aquifer restoration is highly unlikely in this fractured bedrock. (USEPA, 1997a)

In contrast, the remedial action objectives in the Proposed Plan seek to:

- augment the existing groundwater system to contain that portion of contaminated groundwater that is unlikely to be technically practicable to fully restore and restore remaining affected groundwater to State and federal drinking water standards

- remove and treat as much contamination as possible from the fractured bedrock. (USEPA, 1997b)

Because the FS concludes that “[a]quifer restoration is highly unlikely in this fractured bedrock,” the FS remedial action objectives do not seek to restore the groundwater to drinking water standards. The remedial action objectives in the Proposed Plan should be revised to conform to those presented in the FS, with the appropriate revisions discussed above, as follows:

- prevent migration of the contaminated groundwater in the fractured bedrock aquifer; augment the existing groundwater system to contain the contaminated groundwater from all depth zones.

3.3 The USEPA uses a “preliminary” groundwater model in its remedy selection, resulting in misinterpretation of key model parameters and, consequently, a remedy selection process based on incomplete and, at times, inaccurate information.

The groundwater flow model used in the FS as the basis for the selection of the remedy in the Proposed Plan has been acknowledged to be “preliminary” and, therefore, cannot serve as a basis for a properly conducted remedial selection. The groundwater modeling report (FS, Appendix A at 1) states that “the model is . . . preliminary because it was developed using the existing database which contains data gaps.” As the model has not been sufficiently developed and calibrated for use, its predictions relative to groundwater extraction rates and capture zones are highly speculative. Accordingly, using this model as the basis for remedial selection is improper since the proposed remedy is evaluated based on incomplete information.

Proper modeling protocol requires the development of a sound conceptual model, calibration, sensitivity analysis, and a discussion of the uncertainty of the predictions. (Anderson, 1991) The conceptual model incorrectly interprets the water-bearing zones beneath the Site and admittedly contains data gaps. (USEPA, 1994a) Consequently, the groundwater model uses inaccurate assumptions for key model input parameters. Further, only a limited calibration was conducted, with no formal analysis of the sensitivity of the various input parameters. Finally, there is no discussion of the uncertainty of the predicted extraction rate or well placement. The failure to do each of these tasks thoroughly renders the groundwater flow model inappropriate for predictive use. Using the model for predictive use, such as for determining the number of extraction wells, the well locations, the well extraction rates, and aggregate extraction rate, is improper and a remedy should not be selected on the basis of such a model.

As explained in the ECKENFELDER, INC.'s Technical Review of the Remedial Investigation Report, Chemsol, Inc. Site, Piscataway, New Jersey, which was submitted to the USEPA on April 9, 1997, the most significant error in the conceptual model concerns the interpretation of the water-bearing zones beneath the site and the related implications regarding the directions of groundwater flow. Interpretation of the site hydrogeologic conditions is based on a faulty assumption regarding the grouping of wells for mapping purposes. Specifically, the wells have been grouped on the basis of equal elevation rather than on the basis of stratigraphic position within the dipping bedrock units. Experience has shown that this type of approach results in the incorrect determination of groundwater flow directions. (USEPA, 1994a) Indeed, USEPA recognizes that "it is critical that potentiometric surface maps be developed using hydraulic heads measured in comparable stratigraphic intervals to avoid misinterpreting horizontal flow directions, especially where significant vertical gradients are present. . . . Potentiometric surface maps developed from wells completed in different geologic units may result in misleading interpretations and containment." (USEPA, 1994a)

As recognized in the FS report, the results of the packer tests should be used to group the wells for the purpose of potentiometric mapping. The following statement is made on page 1-41 leading to the discussion regarding well grouping:

Based on the results of the packer tests, it appears that:

- the bedrock that lies stratigraphically above the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures),
- the [upper] gray shale appears to be a hydraulic barrier,
- the bedrock below the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures), and
- the deep gray unit may have some hydraulic control, but the collected data are not significant enough to make any conclusion regarding this unit. (USEPA, 1997a)

However, these conclusions, which should have been used as the basis for well grouping for potentiometric mapping, are then not used as wells are subsequently grouped entirely on the basis of elevation. The result of grouping wells based on elevation yields the comparison of data from wells that are in disparate water-bearing zones. As a result, the conceptual model, for example, assumes that groundwater from wells located below the upper gray shale are hydraulically connected to wells at similar elevation above the upper gray shale, even though the

FS concludes the upper gray shale acts as a hydraulic barrier that would prohibit this flow. See Figure 3-2. This misinterpretation precludes the preliminary model's ability to accurately model flow in the Site's complicated geologic units. The geology of the Chemsol site is complicated because of the significantly complex hydrostratigraphic vertical relationships, such as the dipping of the bedrock units and the presence of hydraulic barriers with the associated effects on hydraulic head. Further, groundwater flow at the Site demonstrates a significant downward, vertical flow component due, in part, to the presence of hydraulic barriers. Because the FS model compares wells in disparate water-bearing zones (FS Figures 1-15 through 1-19), thus, not taking into account the complicated groundwater flow regime at the Site, it misinterprets the direction and magnitude of groundwater flow, which renders the model unable to depict site conditions, predict capture zones, or design an appropriate long-term monitoring program.

Regarding data gaps, one of the most significant is the uncertainty of the influence of the "car wash" well. On page 21, the groundwater modeling report states, "[D]uring calibration, it was discovered that the car wash well exerts a major influence on the direction of groundwater gradients on-site and it was important that it be included. However, the actual pumping rate is unknown. Therefore, it was assumed that the average pumping rate is half the capacity of the well." (USEPA, 1997a) It is improper to include this assumption in the groundwater model. First, the basis for this assumed flow rate is not provided. The data from which the "capacity" of the well is estimated is not identified, nor is the rationale for assuming a car wash would be active often enough to account for half of the maximum yield of the well. Any data relied upon must be in the administrative record. Second, according to a representative of the Piscataway Township Department of Public Works, the car wash uses municipal water for its operation and thus the well is not currently in operation. (Potter Affidavit) Mr. Evans further stated that the Department of Public Works has inspected the well on a number of occasions to verify it is not operating. (Potter Affidavit) Accordingly, the influence of the car wash well should not have been considered in the model. Since each of the simulations contained in the FS includes the influence of this well, the model predictions of groundwater extraction rate and capture zone are incorrect.

Another concern with the preliminary model is the assumption that is used regarding the hydraulic conductivity of the bedrock. Overestimating the hydraulic conductivity will correspondingly overestimate the extraction rate necessary to achieve containment. (Freeze, 1979) The preliminary model is "calibrated" using hydraulic conductivities ranging from 20 to 50 ft/day for the "shallow and deep conductive zones," respectively, and 25 ft/day for the intervening "general shale" (Table 9). These values are reportedly based on an analysis of packer

test data. ECKENFELDER INC. has subsequently conducted a more in-depth review of the packer test results, as well as data previously collected by AGES in 1987 and McLaren-Hart in 1993. (Attachments A and B, Appendix A) The results indicate that the hydraulic conductivity for a comparative depth interval (principal aquifer) is approximately 10 ft/day.⁸ Since the groundwater extraction rate necessary for containment is generally proportional to hydraulic conductivity (Freeze, 1979) and the preliminary model uses overestimated hydraulic conductivities, it over-predicts the pumping rates required for containment. This supposition is supported by the results of the MODFLOW model presented in Appendix A to these comments.

Another shortcoming of the preliminary model is the limited calibration that was conducted. On page 11 the groundwater modeling report states, "Since this is a preliminary model application, a limited calibration was performed. This calibration was limited because there are data gaps and because assumptions and interpretations as discussed above had to be made." Model calibration should include "history matching" or simulating the measured response to a known stress, such as the pumping of well C-1 by McLaren-Hart in 1993. (Konikow, 1992) The MODFLOW Model presented in Appendix A is calibrated with "history matching."

As indicated above, the model that forms the basis for the selection of the groundwater extraction remedy is preliminary and should be refined prior to final selection of the number and pumping rate of individual extraction wells. At a minimum, refinement should include:

- Re-grouping of monitoring wells into similar hydrostratigraphic zones, re-contouring groundwater elevations based on this distribution, and using these data for re-calibration. One of the concerns regarding the conceptual basis of the model is the decision to map groundwater elevations as a function of depth below ground surface rather than on the basis of hydrostratigraphic zones. (USEPA, 1994a) When groundwater elevations are contoured based on their appropriate hydrostratigraphic position, as discussed in Section A-1 (Appendix A), groundwater flow is shown to be to the north in each groundwater zone, including the upperzone above the gray shale in which the FS model predicts groundwater flow to the south. Groundwater quality data support this groundwater flow scenario, as dissolved VOCs are detected to the north of the former source area(s). (USEPA, 1996 (Appendix T))

⁸ As shown in Section A 3.5 of Appendix A, a value of 9.5 ft/day is used to calibrate the refined model.

- Refining the assumptions used in the model regarding the operation and pumping rate of the adjacent "car-wash" well. This well is reported not to be in operation and thus both the calibration and prediction runs will need to be revised.
- Revising the boundary conditions. Due to the variable nature of individual water-bearing zones within the Passaic Formation (Michalski, 1990) and the regional dip of approximately 12 degrees (Drake, 1995), the hydrostratigraphic units present onsite do not extend to the regional boundary features used in the model. As a consequence, the influence of these boundaries is over-stated by the model simulations. Considering the relatively small and localized nature of the stress to be simulated, both in calibration and prediction (*i.e.*, pumping several closely spaced wells at relatively small flow rates), a smaller model domain with closer boundaries would more accurately model actual conditions. (Anderson, 1991) The regional boundaries used in the model may be one reason why the on-site flow direction has been incorrectly simulated to the west and south, rather than to the north.
- Revising estimates of hydraulic head based on all the available data. This analysis will yield more accurate estimates of the key aquifer properties (transmissivity) than the current analysis of packer test data. Unlike individual borehole packer tests that measure aquifer properties in the immediate vicinity of the well, the aquifer test induces a more regional (site-wide) stress that, in turn, provides estimates of the bulk hydraulic conductivity of the bedrock. (Freeze, 1979)
- Conducting a transient calibration of the model using the results of the C-1 aquifer test. The closer the predicted stress (in terms of the length of the simulation, number of wells, flow rate, etc.) is to the calibrated stress, the more accurate the predicted response will be. (Konikow, 1992) By calibrating the refined model to accurately simulate the measured response of the C-1 aquifer test, the refined model will be able to more accurately predict the response to slightly different, but similar stresses such as those that would be imposed in operating the proposed remedy.
- Re-evaluating various remedial scenarios using the revised model. Specifically, the simulations should strive to define the optimum number and placement of extraction wells to achieve the containment objective. As discussed above, pumping additional groundwater for the purpose of mass removal should not be a remedial action objective. Due to the effects of matrix diffusion, it is clear that mass removal will not

have an appreciable impact on groundwater quality, nor shorten the duration of the operation of the extraction system. Thus, scenarios that involve the installation and pumping of extraction wells for the sole purpose of mass removal should not be considered, and optimal containment should be the objective of the extraction system.

The modeling report recommends (FS, Appendix A at 22) that "the model should be upgraded from 'preliminary' status to 'predictive' status by resolving data gaps and uncertainties and performing additional calibration. . . . As more specific data is obtained for calibration, it should be used for both remedial design and remediation action activities." (USEPA, 1997a) To this end, the ROD should incorporate these recommendations and provide the necessary flexibility in describing the pumping scenarios to allow a refined model to be developed to optimize the various components of the groundwater extraction system, such as the number of extraction wells, the well locations, the well extraction rates, and aggregate extraction rate.

A modified conceptual hydrogeologic model has been prepared by ECKENFELDER INC., as presented in Section A-1 (Appendix A) of this document. In accordance with USEPA guidance (USEPA, 1994a), this model utilizes well groupings based on hydrostratigraphic units defined on the basis of observed stratigraphic conditions and based on response to the packer pump testing. Finally, this model presents a revised set of the potentiometric surface contour maps for the August 29, 1994 measurement date, which, based on the model refinements, represent more accurately the site conditions than the maps presented in the FS.

On page 9, the groundwater modeling report states that the numerical code used in the Feasibility Study (DYNFLOW) is "certified by the International Groundwater Modeling Center (IGWMC)." However, based on personal communication with Ms. Judith Schenk of the IGWMC (September 16, 1997), the IGWMC does not "certify" groundwater models. Since DYNFLOW is proprietary to CDM, it is not readily available for independent testing or review. It is inappropriate for the USEPA to allow the use of a proprietary model that cannot be scrutinized by the public, as using such a proprietary model provides no meaningful opportunity for public comment.

Nevertheless, since the DYNFLOW code is not available, ECKENFELDER, INC. has used the USGS finite-difference code MODFLOW to incorporate the various refinements recommended in the preliminary modeling report and described above. As further discussed in Section A-2 (Appendix A), the model consists of 5 layers, each representing an individual hydrostratigraphic layer. The boundary conditions are chosen to reproduce the observed groundwater flow direction and gradient at the site. Calibration is conducted both for steady-state, non-pumping conditions,

and under transient conditions to simulate the pumping test at C-1. Calibration statistics are developed using the appropriate well grouping described above and in Section A-2. Last, predictions are made using the refined model to evaluate various containment scenarios.

Using the refined model, two predictions have been made to evaluate groundwater containment. Extraction scenario 1 evaluates the extraction from three (3) on-site wells screened at various depths within the formation. Using these three wells, the model predicts a capture zone similar to CDM's at an estimated flow rate of 25 gpm. This scenario results in capture down to the Lower Bedrock Aquifer. Extraction scenario 2 evaluates the same three wells plus two additional extraction wells located in areas of high contamination in the Upper Bedrock aquitard. Again, this scenario predicts a capture similar to CDM's at an estimated flow rate of 27 gpm. These results are detailed in Section A-3 (Appendix A).

As recited above, the remedy selection process described in the FS and Proposed Plan is based on a "preliminary" model with limited calibration. Because the model relied upon is admittedly "preliminary" and would have to be upgraded to be used for "predictive" purposes, the remedy selection process in the FS and Proposed Plan is based on insufficient and, at times, inaccurate information. At a minimum, the ROD should be written in such a manner to allow for the incorporation of the findings from a refined, calibrated groundwater model.

3.4 The capture zones should be defined by a refined, calibrated groundwater model.

The remedial action objectives set forth in the Proposed Plan seek containment of that portion of the groundwater that is contaminated. The preferred alternative requires groundwater extraction from all groundwater bearing zones up to a saturation depth of approximately 375 feet. The capture zones defined in the FS and Proposed Plan are unnecessarily large to achieve the remedial action objectives, as certain areas within the capture zone are not contaminated. While it is certainly acceptable to provide a buffer zone to ensure adequate capture, no justification is provided in the record for such a large capture zone. Consequently, the ROD should not specify the extent of the capture zone; instead, the capture zone should only be identified as the contaminated area defined by the RI and any additional investigations conducted as part of remedial design and be determined using a refined, calibrated groundwater model.

3.5 Off-site delineation sampling should be limited to the area downgradient of the Site, as defined by the refined groundwater model.

The Proposed Plan states that additional off-site sampling is required to define the extent of any off-site contamination. As described in Section 3.3 and Appendix A, mapping the groundwater elevations based on stratigraphic position in conformance with USEPA guidance shows groundwater flow to be to the north in each groundwater zone, including the upperzone above the gray shale in which the FS model predicts groundwater flow to the south. The ROD should allow refined groundwater modeling to demonstrate the correct groundwater flow direction and limit the off-site delineation sampling to areas downgradient of the site.

3.6 The final remedy must consider the significant constraints on the groundwater treatment plant discharge.

The Proposed Plan states the preferred groundwater remedial alternative would operate at twice the pumping rate of the Interim Remedy; however the FS and Proposed Plan fail to consider the constraints on the discharge from the groundwater treatment plant. While it is true that the capacity of the groundwater treatment plant is 50 gpm, the existing MCUA permit and the NJDEP surface water discharge permit equivalent are based on a discharge flow rate of 30 gpm. These limitations must be considered, as it is anticipated that it is not feasible to discharge 50 gpm to either discharge point.

The MCUA does not favor groundwater treatment plant discharges in its system. Accordingly, the MCUA presently seeks to have the discharge from the Chemsol site removed from its system. In fact, the Chemsol Facility Coordinator has been advised that the MCUA would not approve any increase in flow to its plant from the Site. (Potter Affidavit)

Further, surface water discharge standards are based on surface water quality criteria. Should the flow to the stream be increased, the discharge standards can be expected to decrease to allow for the increased load to the stream. The plant may be unable to meet these lower standards, particularly for inorganics, such as barium and manganese, which are naturally present in the formation.

The final remedy selection must consider the discharge constraints. At a minimum, the ROD should be written in such a manner that the configuration of extraction wells can be designed to achieve the remedial action objectives while minimizing the volume of water to be discharged so

that it may be discharged within the capacity of the existing permits. To achieve this, extraction for mass reduction, in particular, should be eliminated as a remedial action objective. As described in Section 3.1, no significant benefit would be realized by targeting extraction to achieve mass reduction, to the extent it can be achieved at all. The Superfund Administrative Reforms require source removal "only to the degree practicable," not to the degree "possible," as sought in the Proposed Plan's remedial action objectives. (USEPA, 1995) The discharge constraints make any additional pumping targeted for mass reduction impracticable. Further, as described in Section 3.3 and Appendix A, refined modeling demonstrates that the pumping rate need not be twice that of the Interim Remedy to achieve containment. Consequently, the remedial action objectives should be revised to eliminate any reference to mass reduction and to seek containment. At a minimum, the remedial action objectives should be revised to "remove and treat as much contamination as *practicable* from the fractured bedrock."

3.7 The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis.

The USEPA's requirement to operate the biological treatment plant has no technical basis. The proposed remedy requires that the biological treatment plant be operated if the treatment plant effluent is discharged to surface water. In the first place, the operation of the biological treatment plant would not assist in reaching discharge standards; second, the biological treatment plant cannot be effectively operated based on influent concentrations. Moreover, the current plant discharge passes aquatic toxicity testing, indicating further that the requirement is unnecessary.

Presently, the groundwater treatment plant effluent does not meet surface water discharge limits for only barium, manganese and total dissolved solids (TDS). However, aquatic toxicity testing demonstrates the effluent is not toxic to aquatic life. (See attached results) Operation of the biological treatment plant would not assist in reaching the standards for those criteria currently exceeded. As previously stated, the only surface water discharge standards that are exceeded in the plant effluent are for barium, manganese and TDS; there have been no exceedences for soluble organics.

Moreover, the influent concentrations of soluble organics have decreased significantly. Consequently, to successfully operate the biological treatment plant, a supplemental food source would have to be added to establish adequate biofilm growth. The cost estimates in the FS do not consider these excess costs. The current treatment plant operating configuration consistently

provides equivalent removal of soluble organics as was forecasted for the biological treatment plant. Consequently, the requirement to operate the biological treatment plant should be eliminated from the proposed remedy as it is not necessary to achieve the discharge to surface water standards.

3.8 A refined, calibrated groundwater model should be used to develop any long-term monitoring program.

The ROD should state that the long-term groundwater monitoring program will be based on a refined, calibrated groundwater model. The FS recommends twenty (20) existing monitoring wells be used to conduct an annual groundwater monitoring program. The groundwater samples collected as part of this program would be analyzed for TCL organics and TAL inorganics, while stream samples would be analyzed for TCL organics, TAL inorganics, and conventional water quality parameters. However, as previously discussed, any long-term monitoring program must be based on an accurate understanding of the hydrogeologic system. Consequently, the refined groundwater model should be used to structure any long-term monitoring program, including the number and location of wells to be sampled. Further, it is unnecessary to analyze samples collected for select TCL organics, TAL inorganics and, in the case of stream samples, conventional water quality parameters. These requirements are unnecessary in consideration of the site contaminants and, accordingly, should be eliminated.

4.0 CONCLUSION

On behalf of the Chemsol PRP Group, this document comments on the FS and Proposed Plan for the Chemsol site. The comments are summarized below.

- The remedial action objective to allow for future site use without restriction cannot be achieved by the proposed soil remedy. First, because the proposed remedy would not meet the State's PCB soil cleanup criterion, future Site use would continue to be subject to restrictions. Second, current and anticipated future environmental and physical constraints located on the Site prohibit future Site use without restrictions. Consequently, the remedial action objectives should be revised to delete the "without restrictions" requirement.
- A remedial alternative that complies with the State PCB soil cleanup criterion is expected to result in significantly greater costs and increased risk to human health and the environment. Accordingly, if additional excavation is to be considered to achieve the State criterion, the remedy selection would have to be re-evaluated.
- The selection of the proposed soil remedy is not supported by the administrative record.
 - The Proposed Plan requires disposal of soil as hazardous waste; however, in estimating the cost of the proposed alternative, the FS adopts the conclusion reached in the RI that the soil is nonhazardous. Consequently, the ROD cannot require disposal as a hazardous waste because the associated significantly higher disposal costs would have to be considered prior to such a remedy selection.
 - None of the samples analyzed for hazardous characteristics during the RI are within the areal extent of excavation; thus, the RI's conclusion that the soil is nonhazardous is unsupported. The ROD should state that the soil disposal facility would be determined by soil sampling and classification conducted during the implementation of the remedy.
 - Should soil sampling conducted during remedial design indicate a much greater volume of soil requires excavation and disposal to satisfy the remedial action objectives, the remedy must be re-evaluated.
 - Stockpiled soil meeting the criteria for backfill or soil cover should not be required to be disposed of, but should be permitted to be used as acceptable backfill or soil cover.
- A selection of soil capping as the remedial alternative is supported by the administrative record.
 - USEPA guidance, on which soil cleanup levels are based, recommends capping for sites with contaminant concentrations at the levels present at the Chemsol site. Without explanation, the remedy selection process does not follow these guidance documents. The remedy selection should be re-evaluated to correctly apply these guidance documents. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

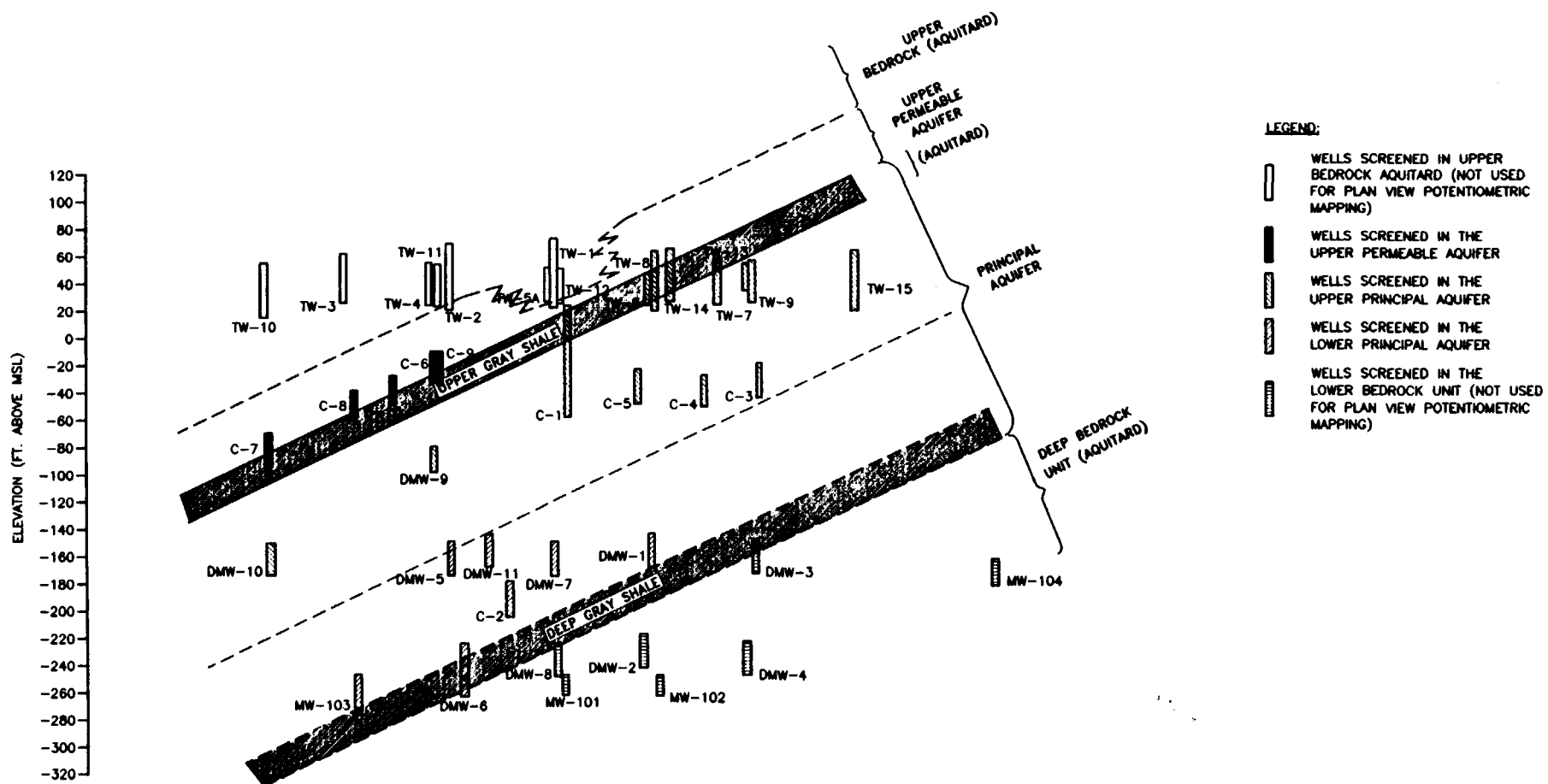
- The FS grossly overestimates the cost for a soil cap. Consequently, there has not been a valid cost comparison of remedial alternatives, as required by the NCP. The remedy selection must be re-evaluated to consider the significantly lower cost estimate.
- The presence of DNAPL in fractured bedrock at the Chemsol site indicates that aquifer restoration is highly unlikely. Accordingly, an ARAR waiver on the basis of technical impracticability should be granted. Furthermore, because groundwater cannot be restored, extraction for mass reduction provides no protection of human health and the environment beyond that achieved by a containment extraction system. In conformance with the NCP, USEPA guidance, and the FS remedial action objectives, the remedial action objectives should be revised to seek hydraulic containment, and references to restoration and mass reduction should be eliminated.
- Because a "preliminary" groundwater model is used as the basis for remedy selection, the proposed groundwater remedy is evaluated based on incomplete and, at times, inaccurate information. As a consequence of the limited calibration and data gaps, the preliminary model misinterprets key model parameters, resulting in an unsupported remedy selection. The ROD should be written in such a manner to allow for the incorporation of the findings from a refined, calibrated groundwater model into the design of the extraction system, the determination of adequate capture zones, the structure of a long-term monitoring program, and the scope of the off-site delineation.
- The final remedy must consider the critical limitations on effluent discharge. In particular, the current discharge permits are based on a discharge flow rate of 30 gpm, and it is anticipated that it would be infeasible to discharge in excess of these limits. At a minimum, the ROD should be written in such a manner that the configuration of the extraction system can be designed to discharge the effluent within the capacity of the existing permits. To achieve this, extraction for mass reduction, in particular, should be eliminated as a remedial objective as it would provide no additional protection of human health and the environment beyond that achieved by containment.
- The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis. The operation of the biological treatment plant would not assist in reaching discharge standards. Also, the biological treatment plant cannot be effectively operated based on influent concentrations. Accordingly, the requirement should be eliminated from the proposed remedy.

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100158

**LEGEND:**

- WELLS SCREENED IN UPPER BEDROCK AQUITARD (NOT USED FOR PLAN VIEW POTENTIOMETRIC MAPPING)
- WELLS SCREENED IN THE UPPER PERMEABLE AQUIFER
- WELLS SCREENED IN THE UPPER PRINCIPAL AQUIFER
- WELLS SCREENED IN THE LOWER PRINCIPAL AQUIFER
- WELLS SCREENED IN THE LOWER BEDROCK UNIT (NOT USED FOR PLAN VIEW POTENTIOMETRIC MAPPING)

NOTES:

1. CONCEPTUAL CROSS-SECTION REPRESENTING ALL BEDROCK WELLS PROJECTED TO A CONCEPTUAL ORIENTATION, ALIGNED PARALLEL TO DIP.
2. ADAPTED FROM RI FIG. 3-3, (CDM,1996)
3. ASSIGNMENT OF WELLS TO VARIOUS HYDRO STRATIGRAPHIC UNITS IS BASED LARGELY ON OBSERVED RESPONSES TO PUMPING.

FIGURE 3-2

PROJECTED BEDROCK CROSS SECTION

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, N.J.

**ECKENFELDER
INC.**

Nashville, Tennessee
Mahwah, New Jersey
Greenville, South Carolina

100159

**APPENDIX A
EVALUATION OF GROUNDWATER
EXTRACTION ALTERNATIVES
CHEMSOL, INC. SITE
PISCATAWAY, NEW JERSEY**

Prepared for:

Chemsol Site PRP Group

Prepared by:

**ECKENFELDER INC.®
1200 MacArthur Boulevard
Mahwah, New Jersey 07430**

October 1997

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TABLE OF CONTENTS

	<u>Page No.</u>
A1.0 INTRODUCTION	A1-1
A2.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL	A2-1
A3.0 GROUNDWATER FLOW MODEL	A3-1
A3.1 Groundwater Model Setup	A3-1
A3.2 Model Boundary Conditions	A3-3
A3.3 Areal Recharge	A3-4
A3.4 External Influences	A3-4
A3.5 Model Calibration	A3-4
A3.6 Model Sensitivity Analysis	A3-8
A4.0 CAPTURE ZONE SIMULATIONS	A4-1
A4.1 Extraction Scenarios	A4-1
A4.2 Model Limitations	A4-3
ATTACHMENTS	
Attachment A - Quantitative Analysis of the Hydrogeologic System	
Attachment B - Aquifer Test Plots and Calculations	
B-1 - Distance Drawdown Analyses of RI Packer Test Data, Well DMW-10 (Round 3, Test 3)	
B-2 - Neuman-Witherspoon Analyses of McLaren/Hart Aquifer Test Data	
B-3 - Theis Type-Curve Analyses of Recover Data from RI Packer Test, Well C-6 (Round 3, Test 3)	
B-4 - Distance-Drawdown Analyses of RI Packer Test Data, Well C-7 (Round 3, Test 3)	
B-5 - Neuman-Witherspoon Analyses of RI Packer Test Data (Round 3, Test 3)	
Attachment C - Well Survey	

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Follows Page No.</u>
A2-1	Well Groupings by Hydrostratigraphic Unit	A2-1
A2-2	Groundwater Elevations	A2-2
A3-1	Chemsol Inc. Site Groundwater Model, Calibration Statistics	A3-7
A3-2	Calibration Parameter, Chemsol Groundwater Model	A3-7
A3-3	Sensitivity Analysis, Chemsol Groundwater Model	A3-8

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Follows Page No.</u>
A2-1	Projected Bedrock Cross-Section	A2-2
A2-2	Conceptual Geologic Cross-Section A-A'	A2-2
A2-3	Conceptual Geologic Cross-Section B-B'	A2-2
A2-4	Potentiometric Contour Map Wells Screened in the Overburden Zone, August 29, 1994	A2-2
A2-5	Potentiometric Contour Map Wells Screened in the Upper Permeable Aquifer, August 29, 1994	A2-2
A2-6	Potentiometric Contour Map Wells Screened in the Upper Principal Aquifer, August 29, 1994	A2-2
A2-7	Potentiometric Contour Map Wells Screened in the Lower Principal Aquifer, August 29, 1994	A2-2
A3-1	Model Grid	A3-2
A3-2	Vertical Profile of Model Grid	A3-2
A3-3	Comparison of Measured and Predicted Head Upper Permeable Aquifer	A3-7
A3-4	Comparison of Measured and Predicted Head Upper Principal Aquifer	A3-7
A3-5	Comparison of Measured and Predicted Head Lower Principal Aquifer	A3-7
A3-6	Comparison of Measured and Predicted Heads	A3-7
A3-7	Modeled (vs) Aquifer Test Drawdown C-4	A3-7
A3-8	Modeled (vs) Aquifer Test Drawdown DMW-5	A3-7
A3-9	Modeled (vs) Aquifer Test Drawdown C-3 & TW-9	A3-7
A3-10	Modeled (vs) Aquifer Test Drawdown TW-8	A3-7
A4-1	Estimated Capture Zone, C-1 @ 15 gpm Principal Aquifer	A4-2

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LIST OF FIGURES (CONTINUED)

<u>Figure No.</u>	<u>Title</u>	<u>Follows Page No.</u>
A4-2	Estimated Capture Zone 1 Well @ 5 gpm Upper Permeable Aquifer	A4-3
A4-3	Estimated Capture Zone 1 Well @ 5 gpm Lower Bedrock Aquifer	A4-3
A4-4	Estimated Capture Zone Pumping 2 Wells @ 1 gpm Ea. Upper Aquitard	A4-3

A1.0 INTRODUCTION

A numerical groundwater flow model was constructed for the Chemsol Inc. Superfund Site both as an interpretative tool and as a tool to evaluate potential groundwater extraction remedies. The interpretative modeling process produced a calibrated base case simulation of existing hydrogeologic conditions, which was then used to evaluate potential remedial scenarios for the Site. The model was used to establish the locations and pumping rates of potential groundwater extraction remedies.

The body of information used to develop the groundwater model was derived from a site-wide Remedial Investigation (RI) which was conducted for Operable Unit I of the Chemsol Inc. property located in Piscataway Township, New Jersey. The field investigation portion of the RI was conducted from October 1992 through November 1994 by CDM Federal Programs Corporation for the U.S. Environmental Protection Agency. The results of the RI were reported in a document titled "Remedial Investigation Report, Chemsol Inc. Superfund Site" (hereinafter referred to as the RI report), dated October 1996.

The RI has been reviewed by ECKENFELDER INC. on behalf of the Chemsol Site PRP Group. The results of this review have been used to support this groundwater modeling effort. ECKENFELDER INC. has performed further analysis of the hydrogeologic data beyond that presented in the RI. This includes a quantitative analysis of pump test data obtained during the RI and previous investigations (See Attachments A and B) and a re-interpretation of the conceptual hydrogeologic model for the site (Section A2.0). The re-interpretation of the conceptual hydrogeologic model serves as the bases for the numerical model presented Section A3.0.

A2.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL

The hydrostratigraphic setting beneath the Chemsol Superfund site is complex, being characterized by a dipping, multi-layered bedrock system. Numerous monitoring wells have been installed at various depths during previous investigations in an effort to evaluate the hydrogeologic and water quality conditions.

A review of the existing hydrogeologic data for the site has been conducted by ECKENFELDER INC. to develop a refined conceptual model of the groundwater flow regime. This conceptual model represents a fundamental departure from that described by CDM in the RI report in that it groups the wells for mapping purposes on the basis of stratigraphic position rather than on the basis of depth (Table A2-1). The current conceptual model was developed based on an analysis of the data from the RI report (CDM, 1996) and further review of previous site investigation data by both McLaren/Hart and AGES Corporation. A quantitative analysis of available pump test data is presented in Attachment A.

The site is conceptually subdivided into six units that have been identified on the basis of site stratigraphy and the observed aquifer response to the various pump tests that have been performed at the site.

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)
- Principal Aquifer
- Deep Bedrock Unit

TABLE A2-1

WELL GROUPINGS BY HYDROSTRATIGRAPHIC UNIT
Chemsol Inc. Superfund Site

Overburden Water-Bearing Zone

OW-1	OW-10	OW-12	OW-14
OW-2	OW-11	OW-13	OW-15
OW-4			

Upper Bedrock Aquitard

TW-1	TW-3	TW-5A	TW-11
TW-2	TW-4	TW-10	TW-12

Upper Permeable Aquifer

C-6	C-8	C-10
C-7	C-9	

Principal Aquifer

Upper Zone

TW-6	TW-13	C-1	DWM-9
TW-7	TW-14	C-3	DMW-10
TW-8	TW-15	C-4	
TW-9		C-5	

Lower Zone

DMW-1	DMW-5	DMW-7	C-2
DMW-3	DMW-6	DMW-11	MW-103

Deep Bedrock Unit

DMW-2	DMW-4	MW-101	MW-104
DMW-3	DMW-8	MW-102	

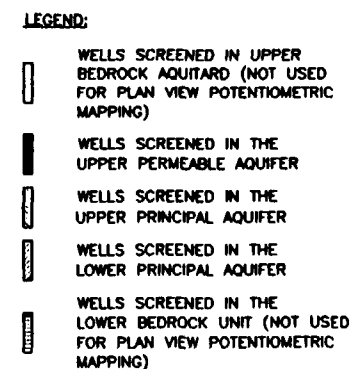
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The hydrostratigraphic units are depicted in the generalized cross section presented on Figure A2-1. Figure A2-1 also depicts the spatial relationship between well screen depth and hydrostratigraphic units. Conceptual geologic cross sections are presented on Figures A2-2 and A2-3.

Based on the well grouping presented in Table A2-1, generalized plan-view potentiometric maps (Figures A2-4 through A2-7) have been prepared that depict static pre-pumping conditions using data obtained on August 29, 1994 (Table A2-2). These include maps for the hydrostratigraphic zones in which horizontal flow predominates including the Overburden zone, Upper Permeable aquifer, and the upper and lower portions of the Principal Aquifer.

The hydrostratigraphic units are described briefly, as follows:

- Overburden Water-Bearing Zone - represents the uppermost water-bearing unit at the site. This zone is contained within the composite unit represented by the thin overburden soils and the upper veneer of highly weathered bedrock. Groundwater within this unit flows laterally toward the northeast (Figure A2-4), generally in response to ground surface topography. The overburden zone is likely to be in hydraulic communication with the small ditches and streams, which flow toward the northeast across the site.
- Upper Bedrock Aquitard - is represented by the bedrock below the overburden zone that is characterized by relatively low hydraulic conductivity. The upper portion of this unit represents weathered bedrock within which the joints and fractures are filled with silt or clay serving to reduce the hydraulic conductivity. As a result, considerable vertical head loss is observed within this unit downward to the underlying Upper Permeable Aquifer. For example, the vertical head difference between well TW-10 screened in the upper portion of this unit with well C-7 screened in the underlying Upper Permeable Aquifer is over 4 feet. The vertical hydraulic conductivity of this unit has been estimated to range from 1.1×10^{-4} to 6.4×10^{-5} cm/sec on the basis of a Neuman-Witherspoon analysis of aquifer test data, described in Attachment A. This is over two



PROJECTED BEDROCK CROSS SECTION

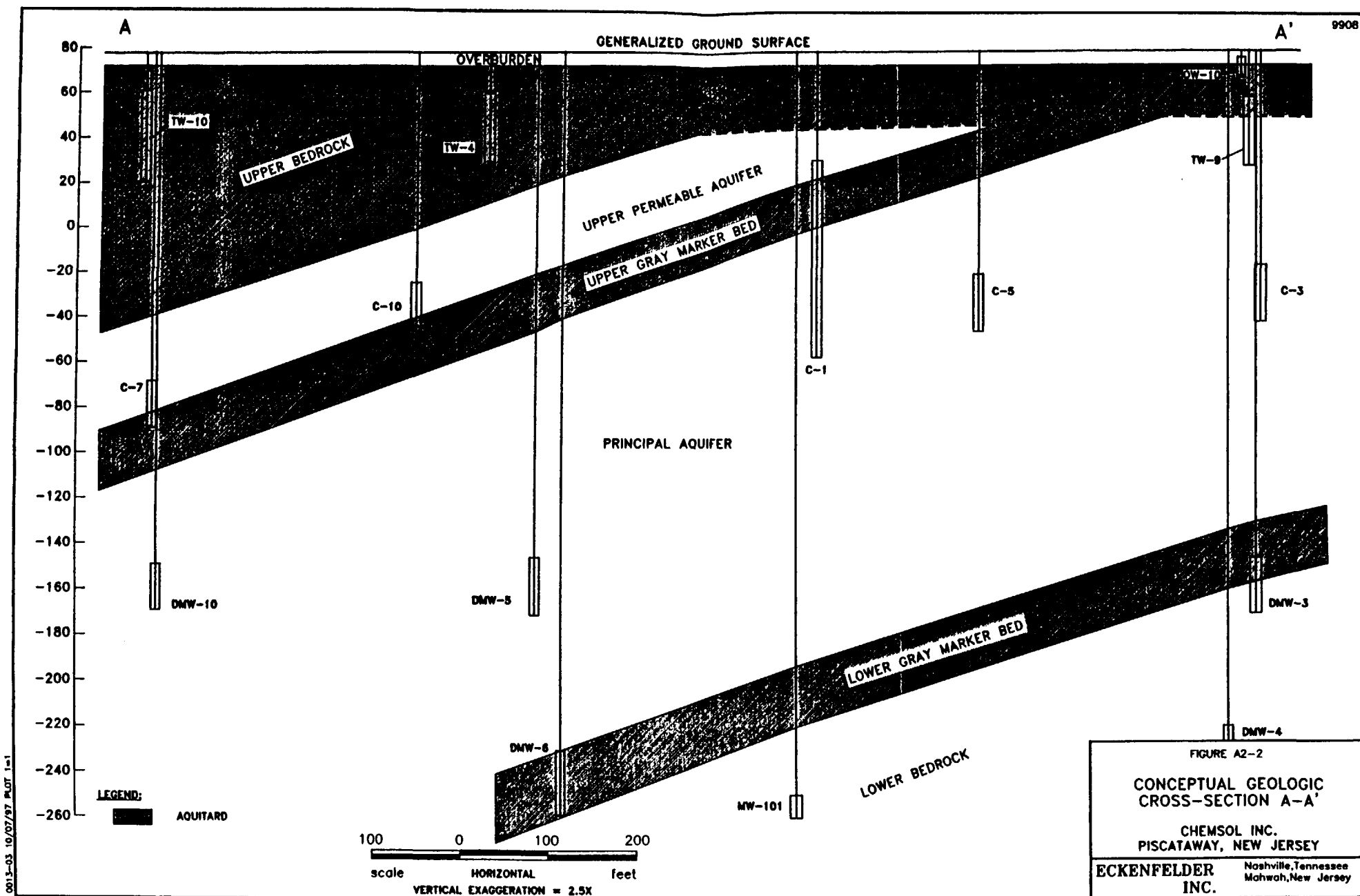
**CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, N.J.**

**ECKENFELDER
INC.**

Nashville, Tennessee
 Mahwah, New Jersey

NOTES:

1. CONCEPTUAL CROSS-SECTION REPRESENTING ALL BEDROCK WELLS PROJECTED TO A CONCEPTUAL ORIENTATION, ALIGNED PARALLEL TO DIP.
2. ADAPTED FROM RI FIG. 3-3, (CDM,1996)
3. ASSIGNMENT OF WELLS TO VARIOUS HYDRO STRATIGRAPHIC UNITS IS BASED LARGEST ON OBSERVED RESPONSES TO PUMPING.



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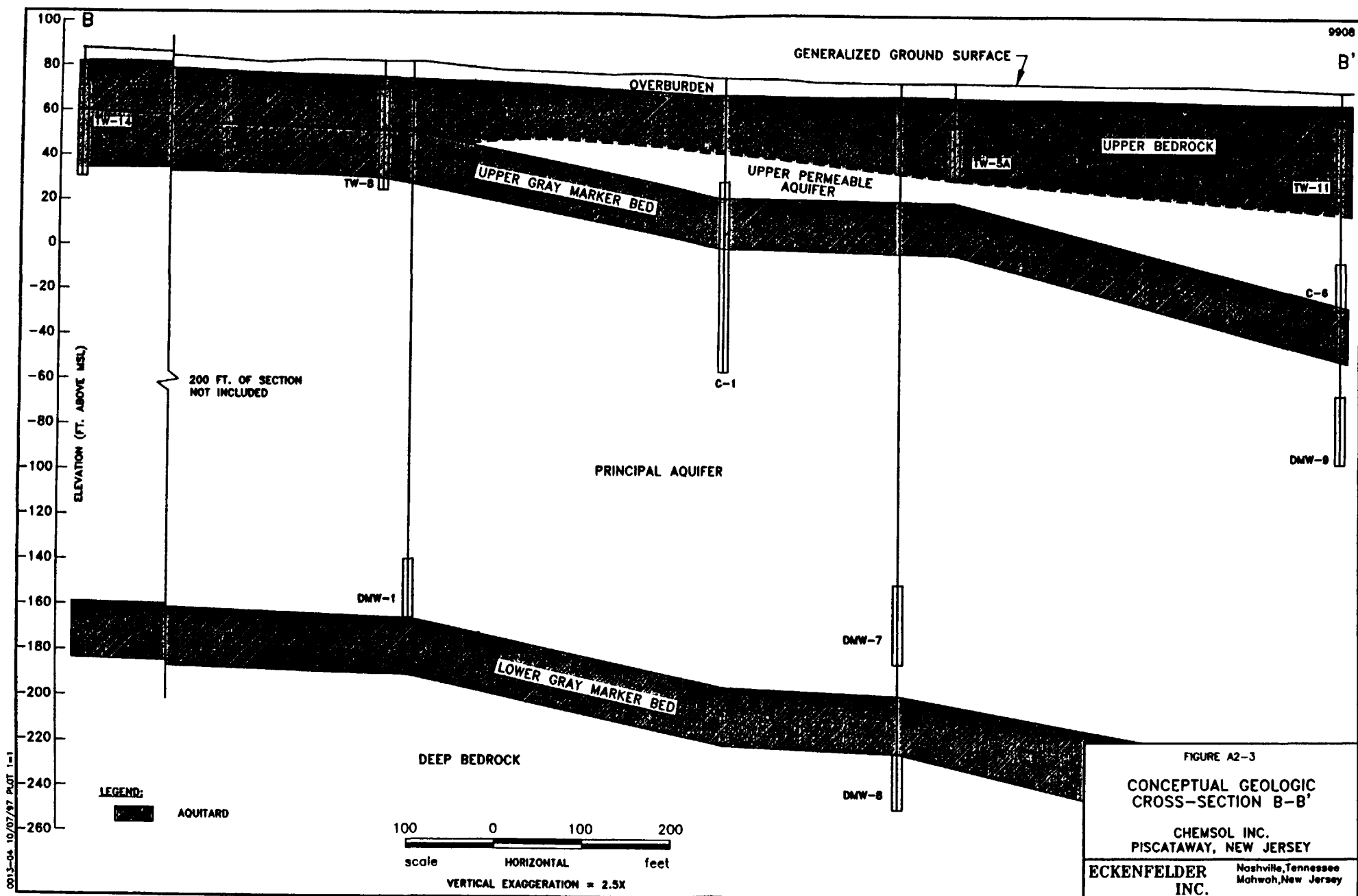


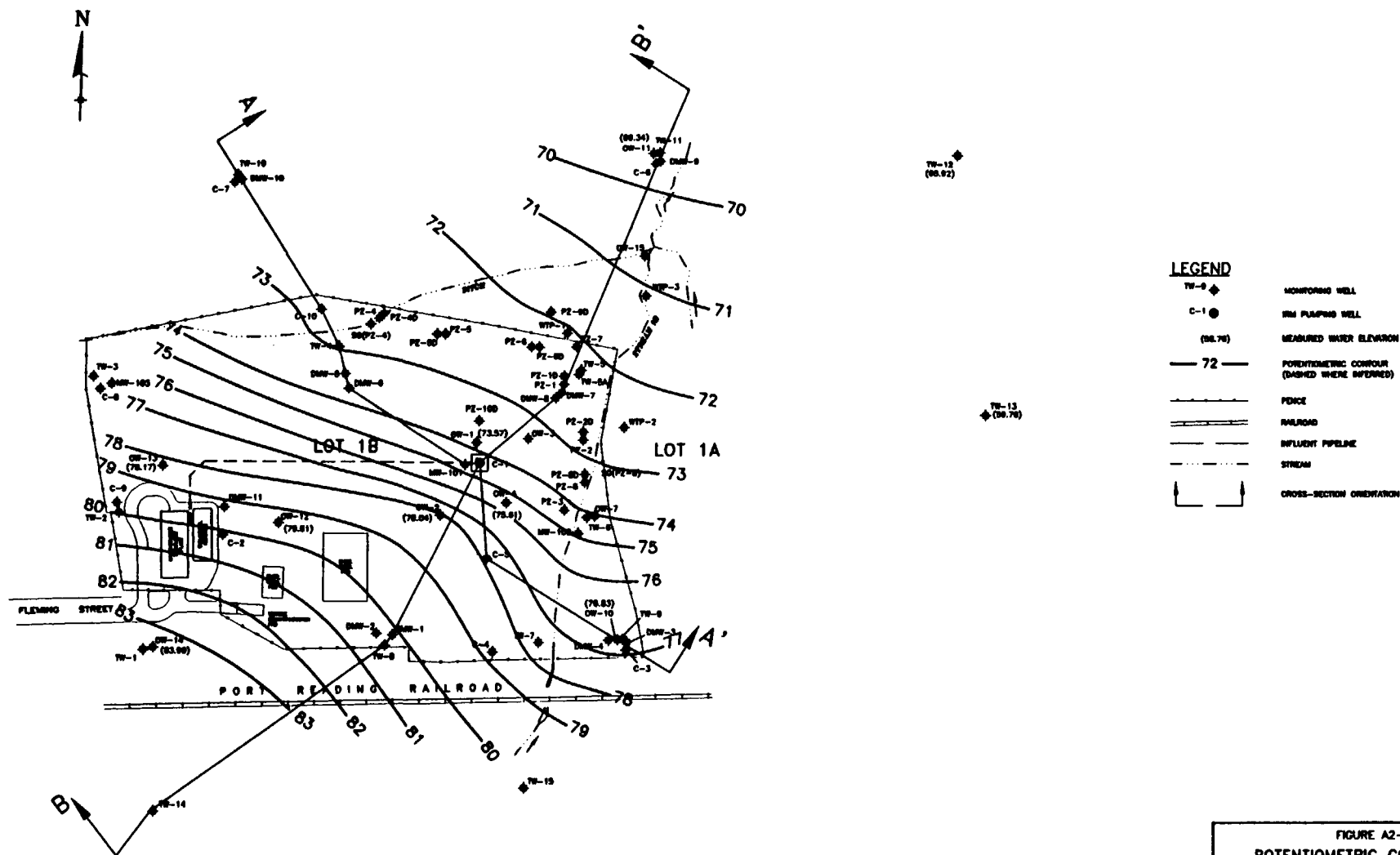
FIGURE A2-3
CONCEPTUAL GEOLOGIC
CROSS-SECTION B-B'

CHEMSOL INC.
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey

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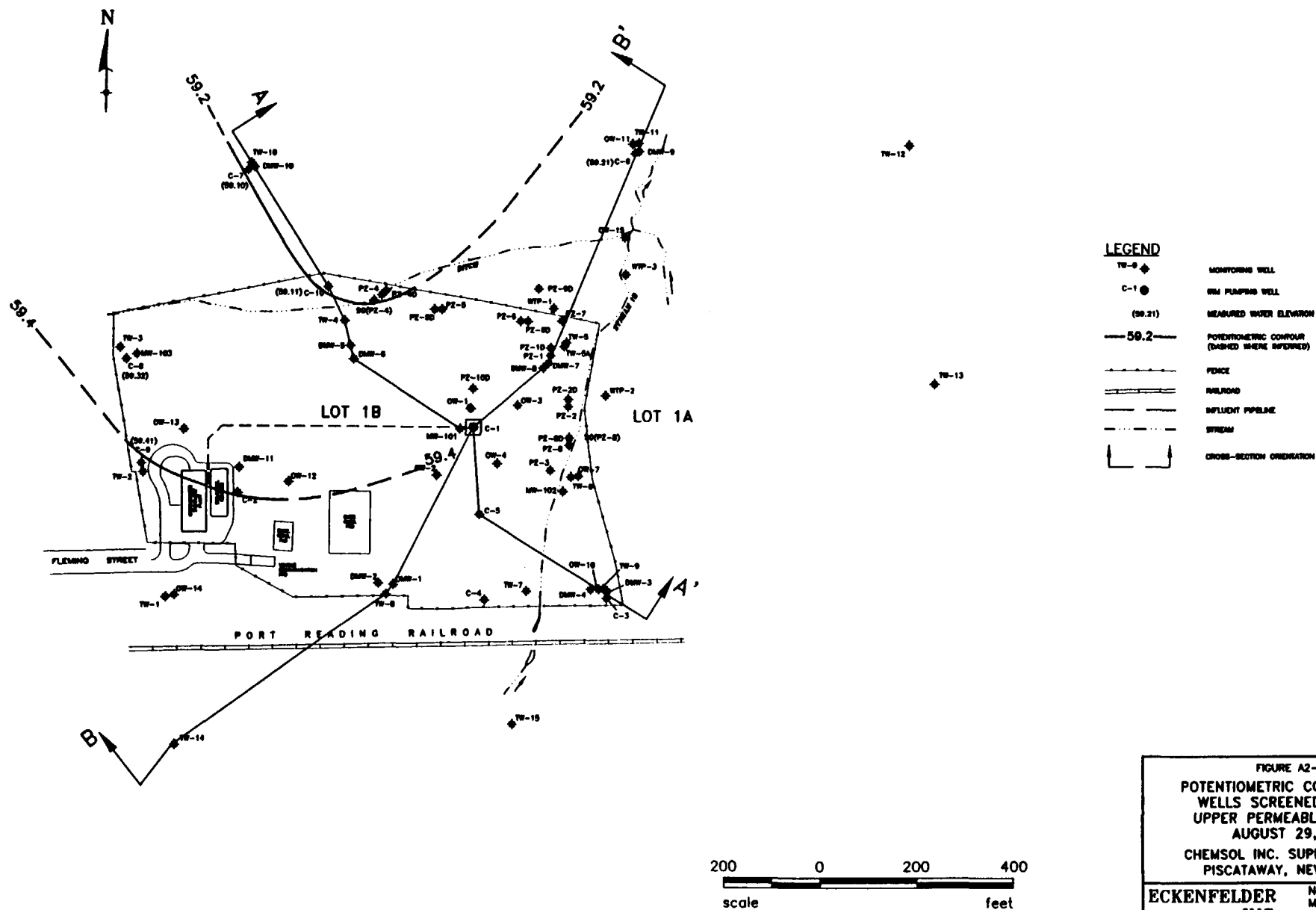


200 0 200 400
scale feet

FIGURE A2-4
POTENTIOMETRIC CONTOUR MAP
WELLS SCREENED IN THE
OVERBURDEN ZONE
AUGUST 29, 1994
CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey



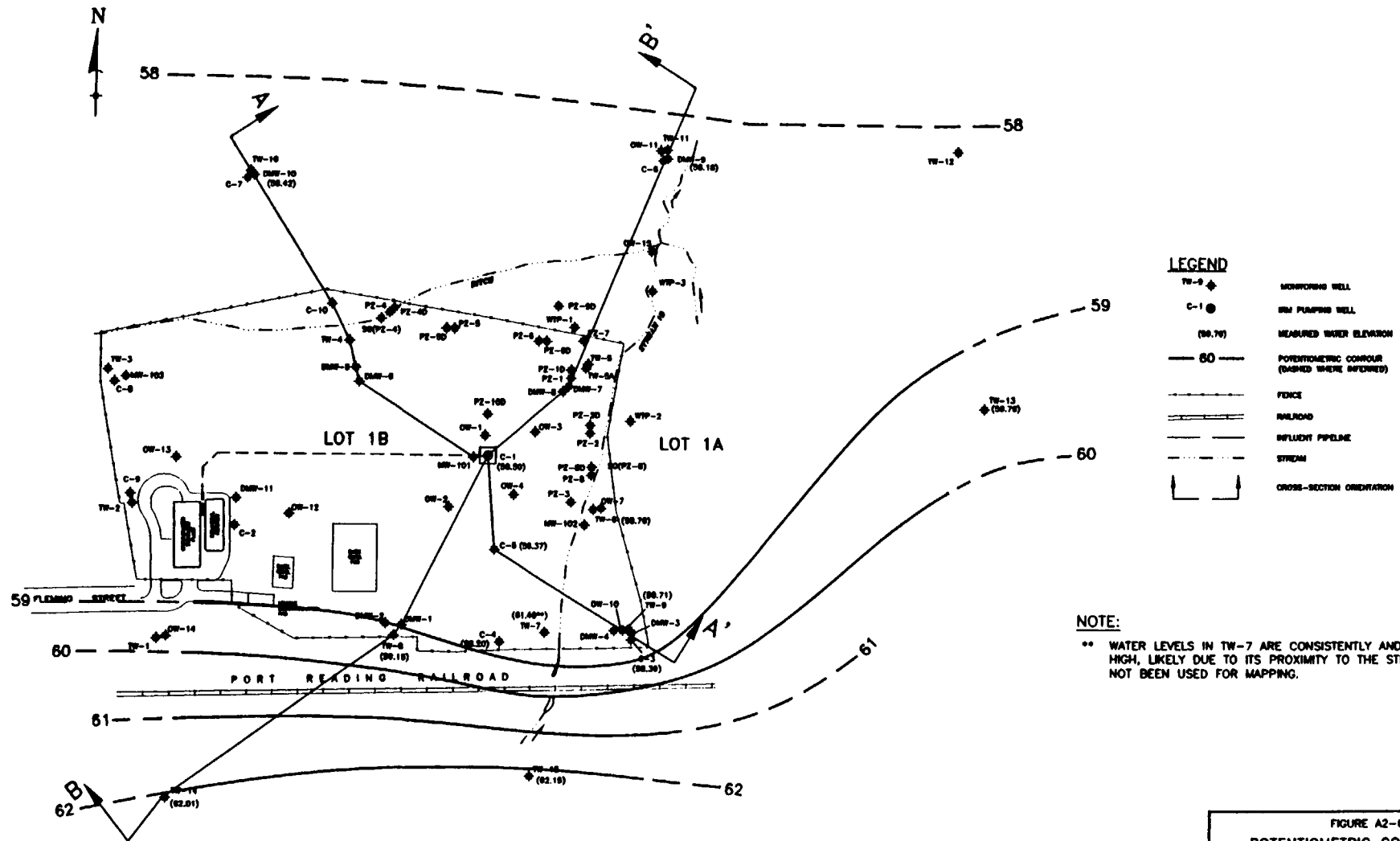


FIGURE A2-6
 POTENTIOMETRIC CONTOUR MAP
 WELLS SCREENED IN THE
 UPPER PRINCIPAL AQUIFER
 AUGUST 29, 1994
 CHEMSOL INC. SUPERFUND SITE
 PISCATAWAY, NEW JERSEY

ECKENFELDER
 INC.

Nashville, Tennessee
 Mahwah, New Jersey

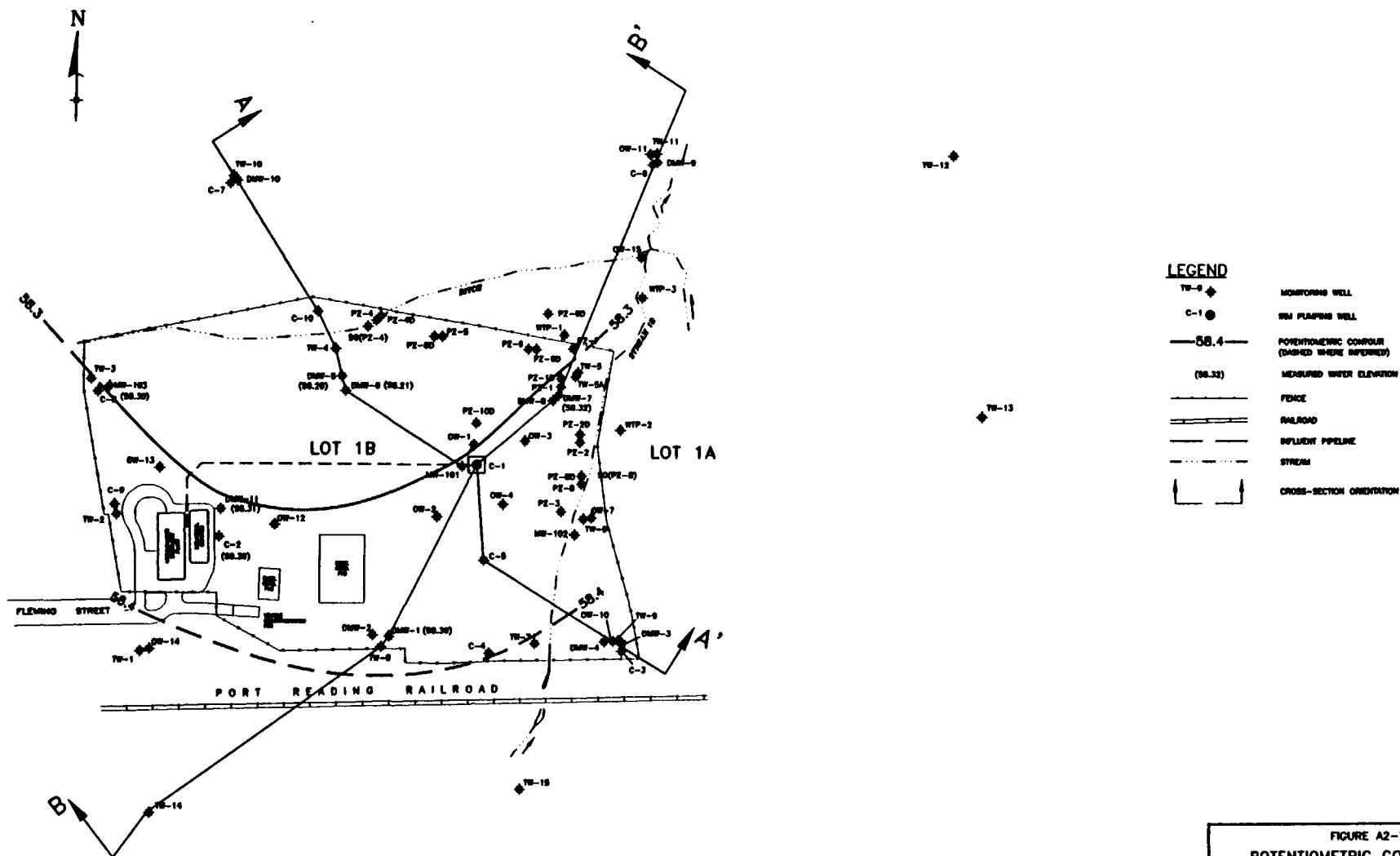


FIGURE A2-7
 POTENTIOMETRIC CONTOUR MAP
 WELLS SCREENED IN THE
 LOWER PRINCIPAL AQUIFER
 AUGUST 29, 1994

CHEMSOL INC. SUPERFUND SITE
 PISCATAWAY, NEW JERSEY

ECKENFELDER
 INC.

Nashville, Tennessee
 Mahwah, New Jersey

TABLE A2-2

**GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY**

Well	Reference	Zone (b.)	Ground	Coordinates (c.)		29-Aug-94	
	Elevation (ft., msl)		Elevation (ft., msl)	Northing	Easting	DTW (ft.)	Elev. (ft., msl)
C-1	79.83	3/4	77.60	629,997	2,062,281	--	58.50
C-2	86.24	5	--	629,865	2,061,790	--	58.36
C-3	80.52	4	78.40	629,642	2,062,565	--	58.39
C-4	80.96	4	79.00	629,636	2,062,307	--	58.20
C-5	80.10	4	78.00	629,815	2,062,297	--	58.37
C-6	76.12	3	--	630,574	2,062,609	--	59.21
C-7	80.20	3	--	630,534	2,061,803	--	59.10
C-8	81.40	3	--	630,140	2,061,554	--	59.32
C-9	85.33	3	--	629,925	2,061,589	--	59.41
C-10	80.71	3	--	630,292	2,061,975	--	59.11
DMW-1	85.40	5	82.90	629,867	2,062,117	--	58.36
DMW-2	85.07	6	83.40	629,670	2,062,085	--	57.86
DMW-3	80.49	6	78.70	629,656	2,062,566	--	58.36
DMW-4	80.44	6	78.60	629,660	2,062,532	--	57.86
DMW-5	78.89	5	77.10	630,166	2,062,022	--	58.28
DMW-6	79.23	5	77.70	630,138	2,062,030	--	58.21
DMW-7	76.62	5	75.60	630,132	2,062,439	--	58.32
DMW-8	77.77	6	76.00	630,121	2,062,428	--	57.85
DMW-9	76.35	4	--	630,578	2,062,618	--	58.18
DMW-10	79.58	4	--	630,540	2,061,816	--	58.42
DMW-11	85.04	5	--	629,918	2,061,792	--	58.31
MW-101	79.80	6	77.40	629,995	2,062,253	--	58.02
MW-102	78.69	6	77.50	629,863	2,062,471	--	57.81
MW-103	81.09	5	80.00	630,144	2,061,572	--	58.30
MW-104	88.58	6	89.00	628,957	2,062,510	--	58.42
OW-1	78.37	1	76.20	630,036	2,062,275	--	73.57
OW-2	81.64	1	79.70	629,898	2,062,206	--	78.04
OW-4	79.96	1	77.60	629,921	2,062,332	--	75.61
OW-10	79.06	1	78.30	629,660	2,062,549	--	76.83
OW-11	75.08	1	74.70	630,592	2,062,609	--	69.34
OW-12	84.65	1	--	629,888	2,061,897	--	79.61
OW-13	82.96	1	--	629,988	2,061,673	--	78.17
OW-14	92.14	1	--	629,643	2,061,657	--	83.99
OW-15	75.08	1	73.00	630,390	2,062,545	NM	NM
PZ 1	76.62	1	74.90	630,157	2,062,437	NM	NM
PZ 1D	77.05	1	--	630,172	2,062,437	NM	NM
PZ 2	76.45	1	74.50	630,051	2,062,474	NM	NM
PZ 2D	75.94	1	--	630,066	2,062,475	NM	NM
PZ 3	78.65	1	74.30	629,919	2,062,438	NM	NM
PZ 4	78.03	1	76.00	630,280	2,062,084	NM	NM
PZ 4D	78.25	1	--	630,289	2,062,090	NM	NM
PZ 5	76.68	1	74.90	630,250	2,062,208	NM	NM
PZ 5D	76.86	1	--	630,251	2,062,193	NM	NM

TABLE A2-2

**GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY**

Well	Reference		Ground Elevation (ft., msl)	Coordinates (c.)		29-Aug-94	
	Elevation	Zone (b.)		Northing	Easting	DTW (ft.)	Elev. (ft., msl)
PZ 6	76.15	1	74.20	630,227	2,062,373	NM	NM
PZ 6D	76.14	1	--	630,227	2,062,389	NM	NM
PZ 7	75.71	1	73.80	630,229	2,062,459	NM	NM
PZ 8	77.57	1	75.70	629,971	2,062,477	NM	NM
PZ 8D	77.51	1	--	629,986	2,062,477	NM	NM
PZ 9D	75.98	1	--	630,295	2,062,410	NM	NM
PZ 10D	79.08	1	--	630,086	2,062,273	NM	NM
SG@PZ 4	71.67	1	--	630,267	2,062,067	NM	NM
SG@PZ 8	73.95	1	--	629,983	2,062,495	NM	NM
TW-1	90.15	2	89.10	629,638	2,061,637	--	59.56
TW-2	85.81	2	84.20	629,900	2,061,591	--	59.98
TW-3	81.59	2	79.60	630,160	2,061,538	--	59.56
TW-4	78.31	2	76.60	630,218	2,062,010	--	59.37
TW-5	76.24	2	74.30	630,175	2,062,475	--	62.98
TW-5A	75.98	2	74.30	630,166	2,062,470	--	62.28
TW-6	78.88	4	76.70	629,894	2,062,490	--	58.76
TW-7	80.16	4	78.10	629,655	2,062,399	--	61.46
TW-8	85.11	4	83.30	629,647	2,062,102	--	59.15
TW-9	80.29	4	78.60	629,662	2,062,557	--	58.71
TW-10	79.96	2	78.50	630,549	2,061,809	--	63.45
TW-11	75.76	2	75.00	630,594	2,062,620	--	67.21
TW-12	75.73	2	73.60	630,594	2,063,195	--	65.27
TW-13	78.17	4	76.30	630,092	2,063,250	--	59.76
TW-14	89.23	4	88.60	629,332	2,061,661	--	62.01
TW-15	82.90	4	82.20	629,380	2,062,367	--	62.15

Notes:**a. Abbreviations are as follows:**

"NE" - no entry to well

"NM" - not measured

b. Wells are screened in the following zones:

1. Overburden Water-Bearing zone
2. Upper Bedrock Aquitard
3. Upper Permeable Aquifer
4. Upper of portion of Principal Aquifer
5. Lower of portion of Principal Aquifer
6. Deep Bedrock Zone

c. Northings & Eastings were obtained from surveyors coordinates, except for "PZ" wells which were obtained from a map by McLaren/Hart.

d. Elevations for PZ wells with D suffix were derived from McLaren/Hart database.

e. Reference elevation for Staff Gauges PZ-4 and PZ-8 are for the 0 ft. mark. DTW reading is above the 0 mark.

100177

orders of magnitude less than the hydraulic conductivity of the underlying Upper Permeable Aquifer. This high permeability contrast results in a predominantly vertical hydraulic gradient within the Upper Bedrock formation.

- Upper Permeable Aquifer - is a highly fractured bedrock zone of relatively high hydraulic conductivity that lies immediately above the upper gray shale. The presence of this unit was initially revealed in boreholes drilled during the RI. These data indicate that this zone ranges from 15 feet to 40 feet thick.

The transmissivity of the Upper Permeable aquifer has been estimated to be approximately 12,650 gpd/ft on the basis of aquifer testing described in Attachment A. Groundwater flow within this unit is predominantly horizontal with a relatively flat hydraulic gradient to the northeast, as shown on Figure A2-5.

- Upper Gray Shale (Aquitard) - Analysis of aquifer test data indicate that the Upper Gray shale provides hydraulic separation between the Upper Permeable Aquifer and the Principal Aquifer. This separation is also observed in the vertical head losses observed between the two aquifers across the Upper Gray shale.
- Principal Aquifer - is comprised of the bedrock zone between the upper and deep gray shale beds with a thickness of approximately 180 feet. The transmissivity of this unit has been shown to be typically on the order of 12,700 gpd/ft with a storativity of approximately 2×10^{-4} , as described in Attachment A.

Slight downward gradients are observed within the Principal aquifer, based on a comparison of wells screened in its upper and lower portions. To evaluate the horizontal components of flow, this unit has been subdivided into an upper and lower portion for mapping purposes, based on the vertical heterogeneity observed during the quantitative analysis (Attachment A). Wells screened in the contiguous upper and deep gray shale units have

been observed to be in sufficient hydraulic communication with the Principal aquifer that they have been included in the potentiometric mapping of this unit. Potentiometric maps for the upper and lower portions of this unit (Figures A2-6 and A2-7, respectively) reveal a northerly direction of groundwater flow.

- Deep Bedrock Unit - includes the bedrock below the deep gray shale. The deep gray shale provides some hydraulic separation between the Principal aquifer and the deep bedrock, determined on the basis of aquifer testing. Insufficient data are available in this unit to determine the horizontal direction of flow.

A3.0 GROUNDWATER FLOW MODEL

A numerical groundwater flow model was constructed for the Chemsol Inc. Site both as an interpretative tool and an evaluation tool for design of the final groundwater remedy. The interpretative modeling process produced a calibrated base case simulation of existing hydrogeologic conditions, which was then used to evaluate potential remedial scenarios for the Site. The model was used to evaluate the capture zones produced by various combinations of extraction well locations and pumping rates.

A3.1 GROUNDWATER MODEL SETUP

The modular, three-dimensional, finite difference groundwater flow model code, typically referred to as MODFLOW, was used for this project. The original code was developed by the U.S. Geological Survey (McDonald and Harbaugh, 1988); however, a slightly modified version of the code marketed by Boss International Inc. was used for this Site. This version is designed to interact with the Groundwater Modeling System (GMS), a pre- and post-processor developed by Boss International Inc.

As presented in Section A2.0, the hydrostratigraphic setting beneath the Chemsol Superfund site is complex being characterized by a dipping, multi-layered bedrock system. Based on the quantitative analysis (Attachment A) and the stratigraphic regrouping of monitoring wells, the site has been conceptually subdivided into six hydrostratigraphic units. The units are as follows:

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)
- Principal Aquifer
- Lower Gray Shale (Aquitard)
- Deep Bedrock Unit

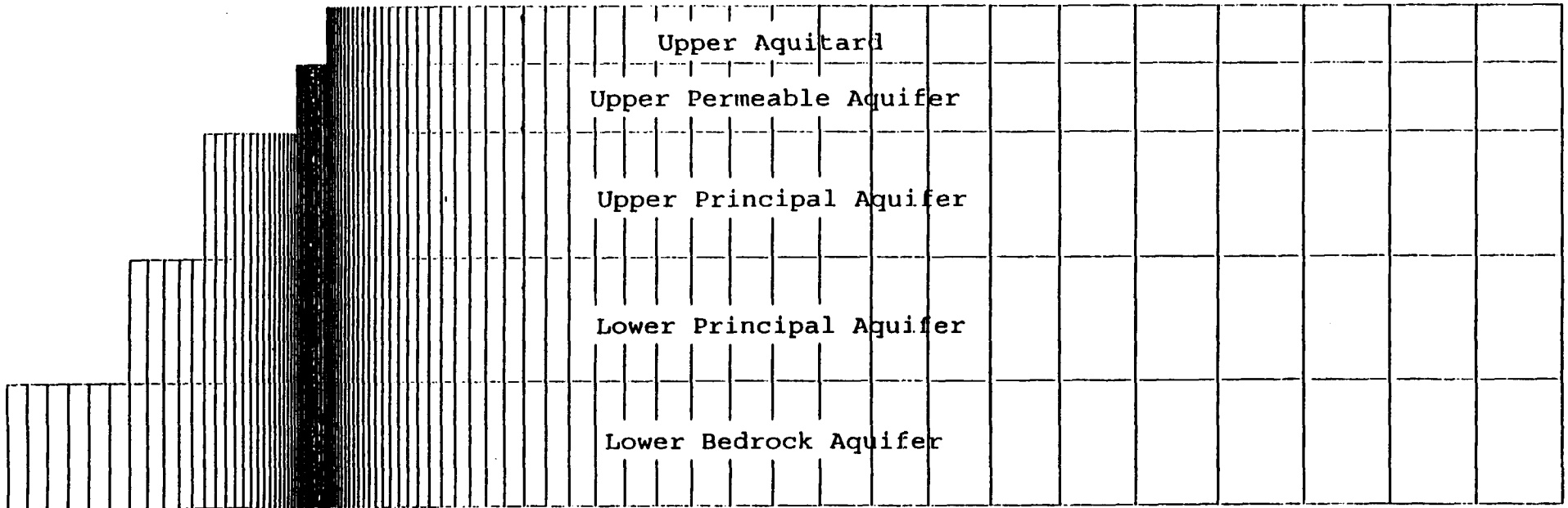
Each of these hydrostratigraphic units dips to the north-northwest and subsequently sub-crop on, or within the vicinity of, the site (see Figures A2-2 and A2-3). The

regional model grid used in this analysis is superimposed over the project area on Figure A3-1. The grid is centered around the site and consists of 43 rows and 87 columns. The model grid is bounded to the north by Bound Brook and extends approximately 7,770 feet southwest, and 5,220 feet northeast from the Chemsol Inc. Site. The grid was limited in extent in the southwest and northeast directions due to the lack of geologic information available off site. The grid extends to the southeast, corresponding to the sub-crop of the associated hydrostratigraphic units. The dimensions of individual cells range from 10 feet by 10 feet at extraction well C-1 within the central portion of the project area, to 810 feet by 720 feet near the perimeter of the grid. The finer grid spacing was selected to provide a more refined depiction of conditions at and near the Site, whereas larger cells were used beyond the project area which is not likely to be influenced by the proposed remedial activities and where little field data exists for comparison. The grid has been oriented to the north-northwest so that the X-axis of the grid parallels the sub-crops of the primary hydrostratigraphic units.

Vertically, the grid consists of five layers:

- Layer 1 - Upper Bedrock Aquitard
- Layer 2 - Upper Permeable Aquifer
- Layer 3 - Upper Principal Aquifer
- Layer 4 - Lower Principal Aquifer
- Layer 5 - Lower Bedrock Aquifer

Setup of dipping layers within MODFLOW can be accomplished by representing the dipping hydrostratigraphic units as horizontal grid layers (Anderson, 1991). The vertical grid configuration used to represent the hydrostratigraphic units is presented on Figure A3-2. The stair-step grid configuration represents the hydrostratigraphic sub-crops. Areal recharge is applied to the upper most active layer within the model. That is, recharge will be applied to the entire surface of layer 1, and only to exposed portions of the grid for Layers 2, 3, 4, and 5, representing recharge to the sub-crop areas. The Shallow Gray Marker Unit and the Deep Gray Marker Unit are represented as leakance terms. The Overburden Water-Bearing Zone was not represented in the model due to its limited vertical extent.



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FIGURE A3-2

VERTICAL PROFILE OF
MODEL GRIDCHEMSOL INC. SUPERFUND SITE
UPPER PERMEABLE AQUIFER

ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

Layer 1 simulates groundwater flow within the Upper Aquitard which overlies the primary water bearing units. Although layer thickness is not entered into the model directly, transmissivity was used to represent the pinching out of Layer 1 on site.

Layer 2 represents groundwater flow within the Upper Permeable aquifer. The thickness of the Upper Permeable aquifer was estimated to range from a pinch-out to approximately 40 feet.

Layer 3 represents groundwater flow within the Upper Principal Aquifer. The thickness of this unit was estimated to range from a pinch-out to approximately 91 feet. Layer 4 represents the Lower Principal Aquifer. The thickness of Layer 4 was assumed to be the same as Layer 3. This division of the Principal aquifer is based on the observed head differences between the top and bottom of the unit and the vertical heterogeneity observed within the unit as part of the quantitative analysis (see Attachment A).

Layer 5 represents groundwater flow within the Lower Bedrock Aquifer. Although little information is available for this unit, its thickness was assumed be approximately 150 feet.

A3.2 MODEL BOUNDARY CONDITIONS

Based on the observed groundwater flow directions on-site (generally to the north-northeast) Bound Brook is considered to be the natural hydraulic boundary for model Layer 1 through Layer 5 and has been simulated using "river" cells. An approximate elevation of the surface water (specified head) in these cells was obtained from the USGS topographic map.

The southwest and northeast model perimeter is simulated using "general head" boundary (GHB) cells. These boundary cells simulate the extension of the aquifer beyond the model boundary by allowing water to enter or exit the model domain as a function of the local gradient, transmissivity, and cell dimensions. The specific head values used were estimated by projection of groundwater elevation data collected from the Site on April 29, 1994 and by the elevation of Bound Brook.

The southeastern perimeter of the model domain represents the pinch-out associated with the sub-crops of the water-bearing units. Consistent with a pinch-out, the southeastern perimeter is represented as a no-flow boundary.

A3.3 AREAL RECHARGE

CDM Federal Programs Corporation (March 1996) completed a water budget for the area associated with Chemsol Inc. Site. The results of the water budget suggest that area recharge is likely to range between 4 and 7.5 inches pre-year. However, since the current model configuration does not include the Overburden Water-Bearing Zone. The "effective" recharge to the bedrock units will be considerably less than the estimated 4 to 7.5 inches per year.

A3.4 EXTERNAL INFLUENCES

A well record survey was conducted in the area surrounding the Chemsol Site to identify potential discharges that may be influencing groundwater conditions associated with the site. Searches for high capacity wells (greater than 100,000 gpd) and lower capacity wells have been completed. The results of this well record survey are presented in Attachment C and indicate 12 high capacity wells are located within 1 to 2 miles of the site. A review of the screened intervals and relative position to the site, as related to our understanding of the area hydrogeology, indicates that their influence on the site would likely be small. Additionally, all identified well locations fell out-side of the model domain. Numerous low capacity wells were also identified (see Attachment C). The closest well to the site that would likely have an impact was the "car wash" well. However, information provided by Piscataway Township indicates that this well is not currently in operation.

A3.5 MODEL CALIBRATION

For this report, the term calibration refers to the standard approach (Anderson, 1991) of matching measured heads to model heads at steady-state conditions and adjusting input parameters within reasonable limits until an acceptable match is achieved. However, this process alone may not result in a unique set of parameters

because different combinations of parameters may produce an equally good match with measured heads. The steady-state calibration process, therefore, was supplemented by the simulation of a measured hydraulic response to a known stress (aquifer test data). Data were collected from an aquifer test conducted McLaren/Hart in 1993 and used in the transient calibration.

The first step in the calibration process is the selection of initial input parameters. The values used for the initial run were obtained from the results of the RI and quantitative analysis (see Attachment A) and are summarized below.

- Layer 1 (Upper Bedrock Aquitard) was simulated as a MODFLOW aquifer type 3 (confined). A Neuman-Witherspoon analysis was completed of this unit. The results of this analysis indicated that the vertical hydraulic conductivity ranges from 0.18 ft/day to 0.31 ft/day. The horizontal hydraulic conductivity is estimated to be 1 ft/day to 4 ft/day, assuming that the horizontal hydraulic conductivity of the unit is approximately 10 times that of the vertical hydraulic conductivity. For the initial run, a hydraulic conductivity of 2.5 ft/day was used. These values of hydraulic conductivity are consistent with the conceptual view that this unit is an aquitard.
- Layer 2 (Upper Permeable Aquifer) was simulated as a MODFLOW aquifer type 3 (unconfined/confined). Two-packer tests were completed in this unit resulting in a transmissivity of 1,644 ft/day and 1,737 ft/day. A hydraulic conductivity of 1,690 ft/day was used in the initial run.
- Layer 3 (Upper Principal Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). As presented in the quantitative analysis (see Attachment A) transmissivity was found to range from 668 ft/day to 3,877 ft/day. The transmissivity of this unit has been shown to be typically on the order of 1,700 ft/day with a storativity of approximately 2×10^{-4} . The vertical hydraulic conductivity was estimated to be 0.99 ft/day. These parameter values were used in the initial run.

- Layer 4 (Lower Principal Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). The initial aquifer characteristics and parameters are consistent with that estimated for Layer 3 (Upper Principal Aquifer).
- Layer 5 (Lower Bedrock Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). The aquifer characteristics and parameters are consistent with that estimated for Layer 3 (Upper Principal Aquifer). As a result, a transmissivity value of 1,425 ft/day was used in the initial run.
- As discussed in Section A3.3, the "effective" aeral recharge is expected to be less than the 4 to 7.5 inches per year estimated in the water budget. Based on previous experience, an initial estimate of 4 inches per year was chosen to begin the model calibration process. Areal recharge rate at the various sub-crop areas is likely to be greater than that associated with the lower permeability, Upper Aquitard. Therefore, aeral recharge associated with the Upper Aquitard was considered approximately 50 percent less than that of the aquifer sub-crops.
- The quantitative analysis (see Attachment A) indicated that the Upper Gray Shale and the Deep Gray Shale provided hydraulic separation between the associated aquifers. Therefore, these aquitards are represented in the model as leakance terms. Since quantitative estimates of leakance are not available from the field data, an initial leakance value of 0.0001/day was selected to begin the model calibration process based on experience.

Once the initial input parameters were selected, the initial base case simulations were conducted and results were evaluated using a head residual analysis. A head residual is the difference between the measured head in a well and the model-predicted head in the cell that represents the location and depth of the well. Positive residuals indicate the predicted head is lower than the measured value, whereas negative residuals indicate the predicted head is higher than the measured value. The sum of the residuals is an indicator of an overall bias (heads generally too high or too low) in the prediction. If, for example, the predicted heads were quite close to the measured heads but most were slightly higher, this term would be

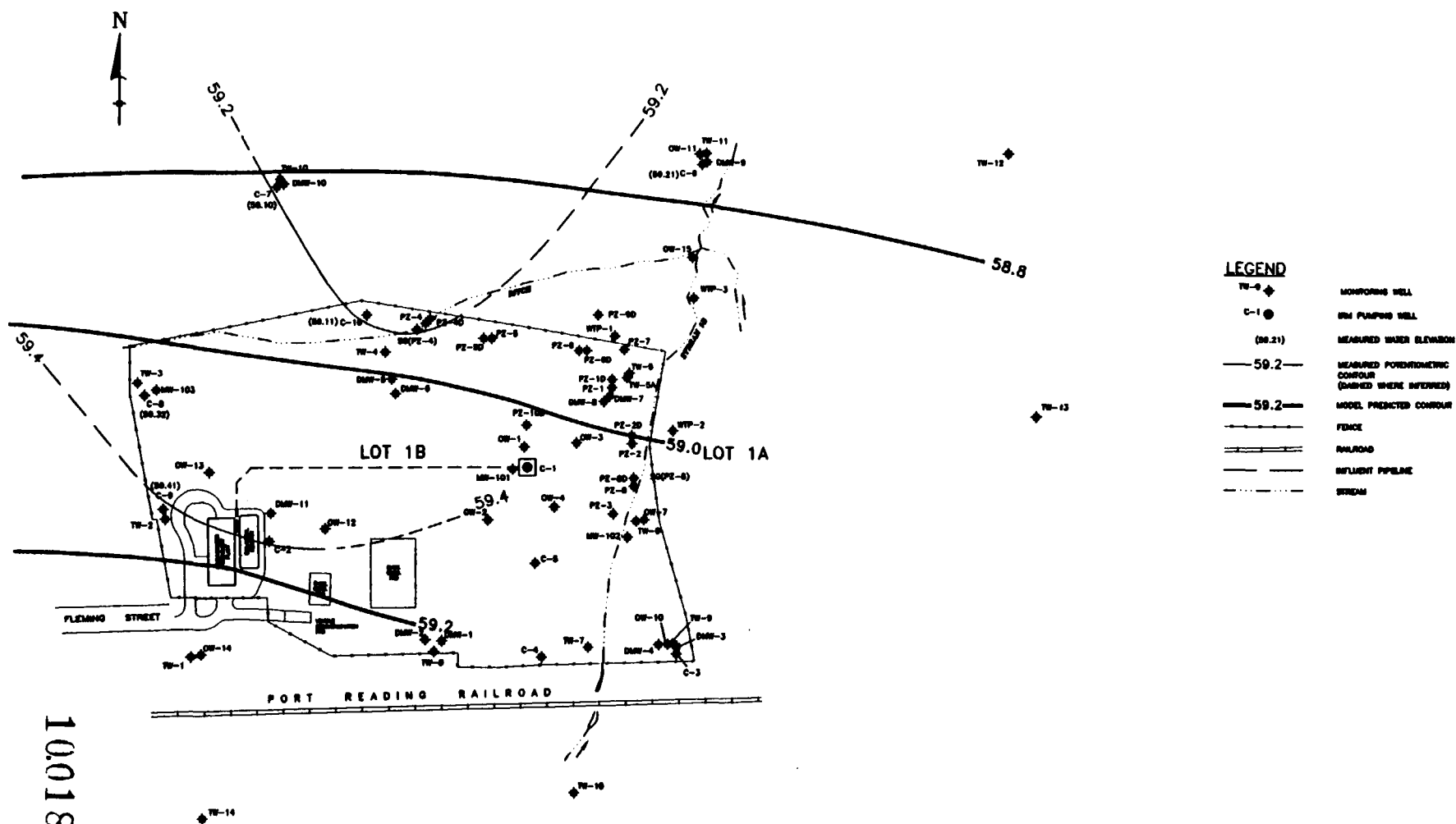
elevated in the negative direction. The average of the absolute residuals is an indicator of the accuracy of the match and, as a general rule, should be less than 10 percent of the steady-state head change across the project area. Depending on the layer, head changes across the site range from 12 feet in the Overburden to less than 0.2 feet in the Lower Principal Aquifer. A target residual of 0.5 feet was selected for this site as it represents a head change in the middle of this range (5 feet) and is consistent with the head change of the Upper Principal Aquifer.

During the steady-state calibration process, the various input parameters were adjusted within reasonable limits and the results noted. This process was continued until an acceptable match (as defined above) was made with head values measured on April 29, 1994. Table A3-1 presents the results of the calibration simulation. Of the 28 measured values, the sum of all residuals is -4.89 feet and the average of the absolute residuals is 0.47 feet which meets the 10 percent guideline defined previously.

The simulation using the calibrated, steady-state base case model parameters was further evaluated by comparing the computed head configuration with the contoured groundwater elevation data collected on April 29, 1994. The comparisons for the model heads versus measured heads for the Upper Permeable Aquifer, the Upper Principal Aquifer and the Lower Principal Aquifer are provided on Figures A3-3, A3-4, and A3-5, respectively. Considering the uncertainty associated with fractured bedrock flow systems, the comparisons of measured head contours to modeled head contours indicate a reasonable match to field conditions.

An additional observation, with respect to groundwater elevation data, relates to the additional potentiometric surface map developed from groundwater elevation data collected in April 1997. This potentiometric surface represents groundwater conditions within the Upper Principal Aquifer following approximately two years of pumping C-1 at approximately 22 gpm. As shown on Figure A3-6, the general configuration of the observed head distribution was reproduced by the calibrated model.

To further test the calibrated model, a transient calibration was conducted using aquifer test data collected by McLaren/Hart in 1993. McLaren/Hart conducted an



200 0 200 400
scale feet

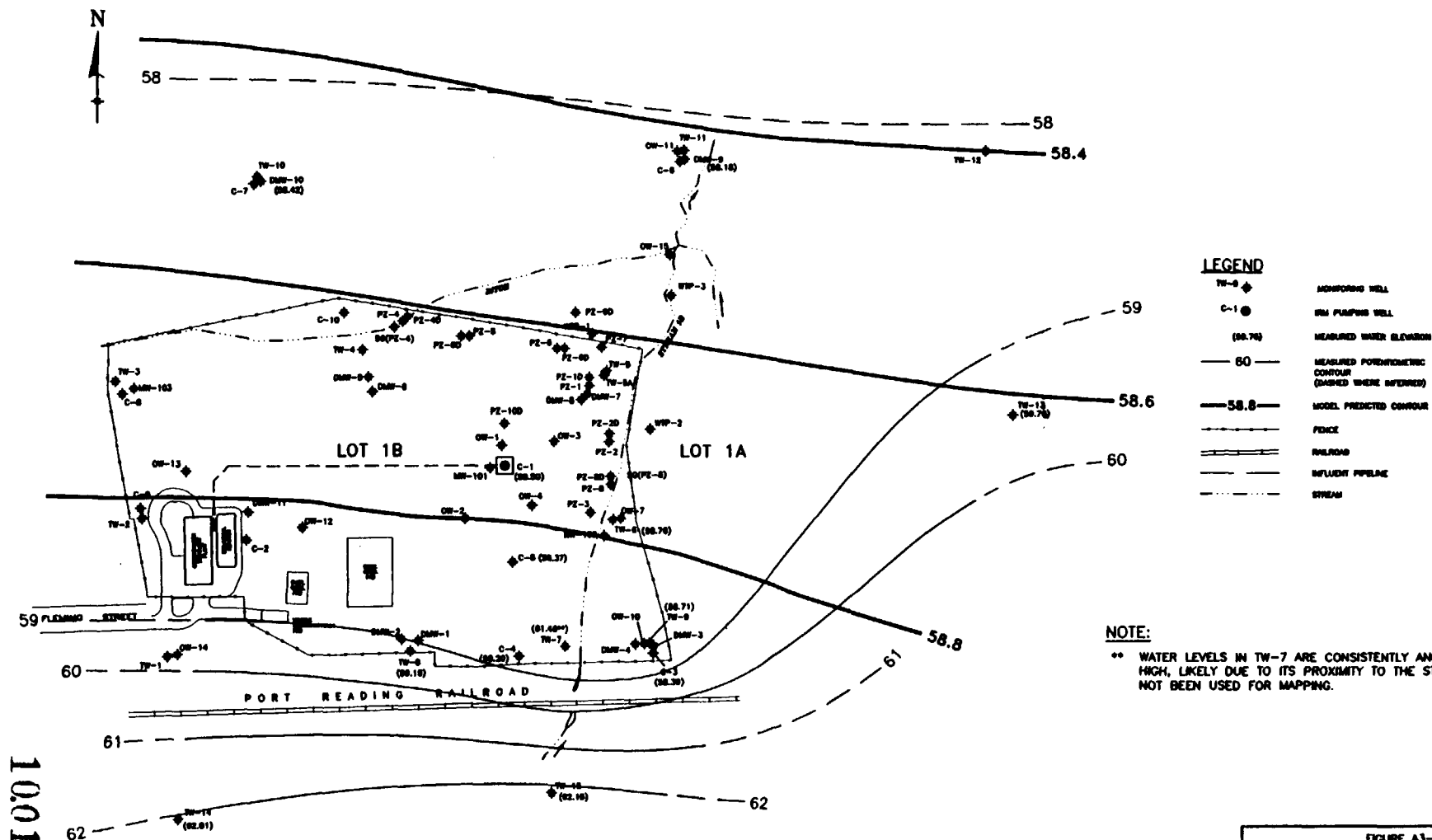
FIGURE A3-3

COMPARISON OF MEASURED
AND PREDICTED HEAD
UPPER PERMEABLE AQUIFER

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey



NOTE:

** WATER LEVELS IN TW-7 ARE CONSISTENTLY AND ANOMALOUSLY HIGH, LIKELY DUE TO ITS PROXIMITY TO THE STREAM, AND HAVE NOT BEEN USED FOR MAPPING.

NOTE:

POTENTIOMETRIC CONTOURS BASED ON HEAD MEASUREMENT COLLECTED ON AUGUST 29, 1994.



FIGURE A3-4

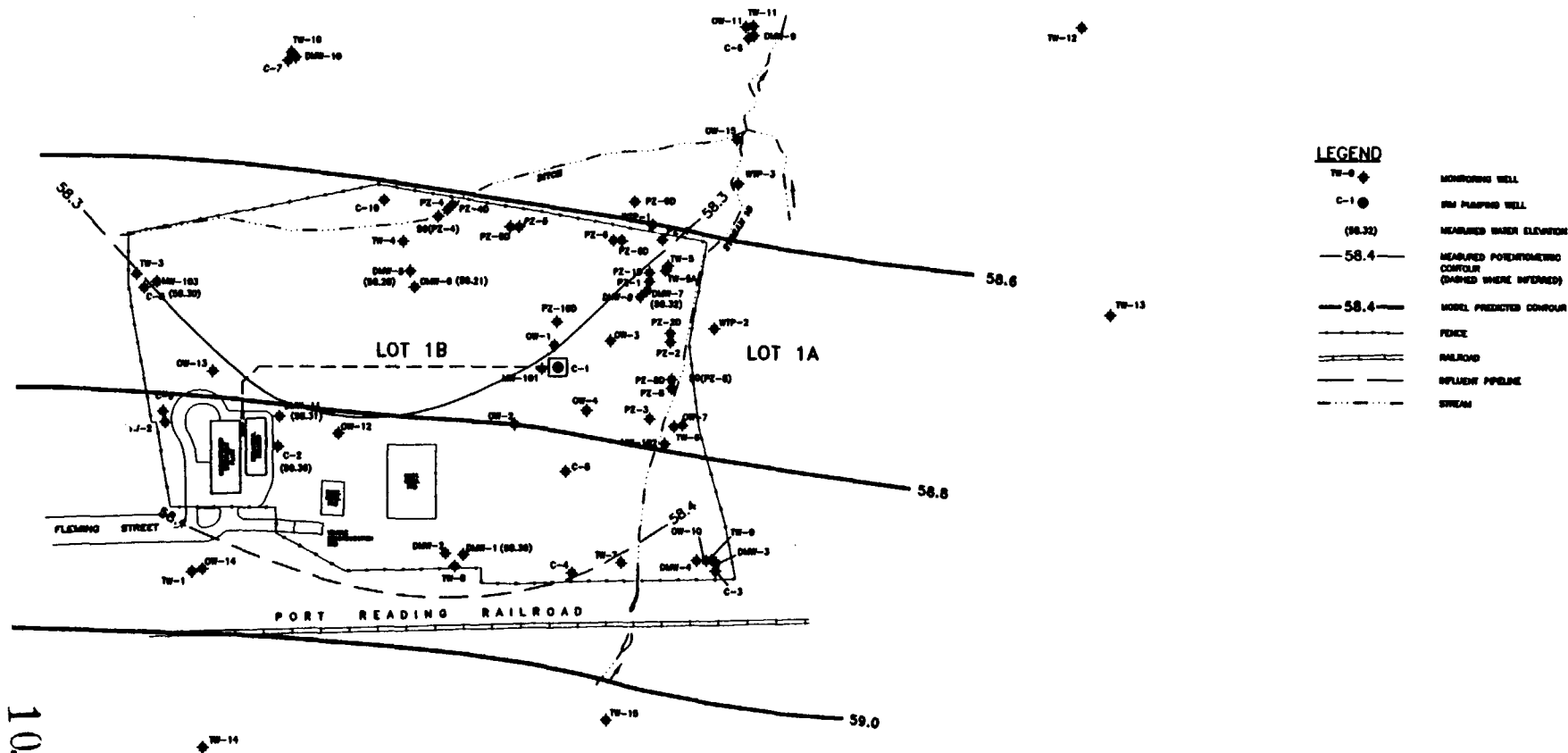
COMPARISON OF MEASURED
AND PREDICTED HEAD
UPPER PRINCIPAL AQUIFER

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey

10.0189



LEGEND

- TW-1 ◆ MONITORING WELL
- C-1 ● RECOVERY WELL
- (58.32) MEASURED WATER ELEVATION
- 58.4 — MEASURED POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)
- - - 58.4 - - - MODEL PREDICTED CONTOUR
- FENCE
- RAILROAD
- EFFLUENT PIPELINE
- STREAM

FIGURE A3-5

COMPARISON OF MEASURED
AND PREDICTED HEAD
LOWER PRINCIPAL AQUIFER

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

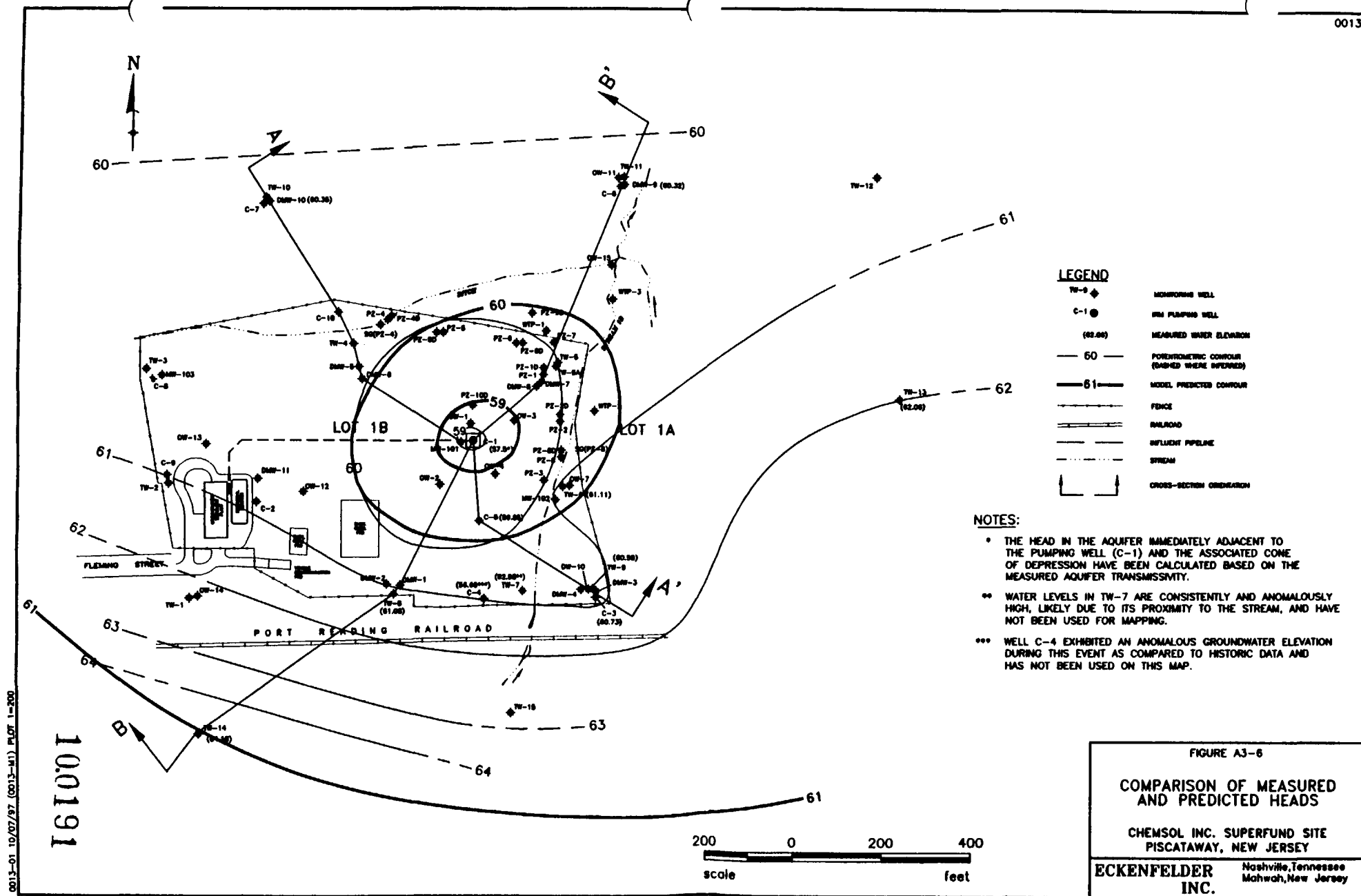
ECKENFELDER
INC.

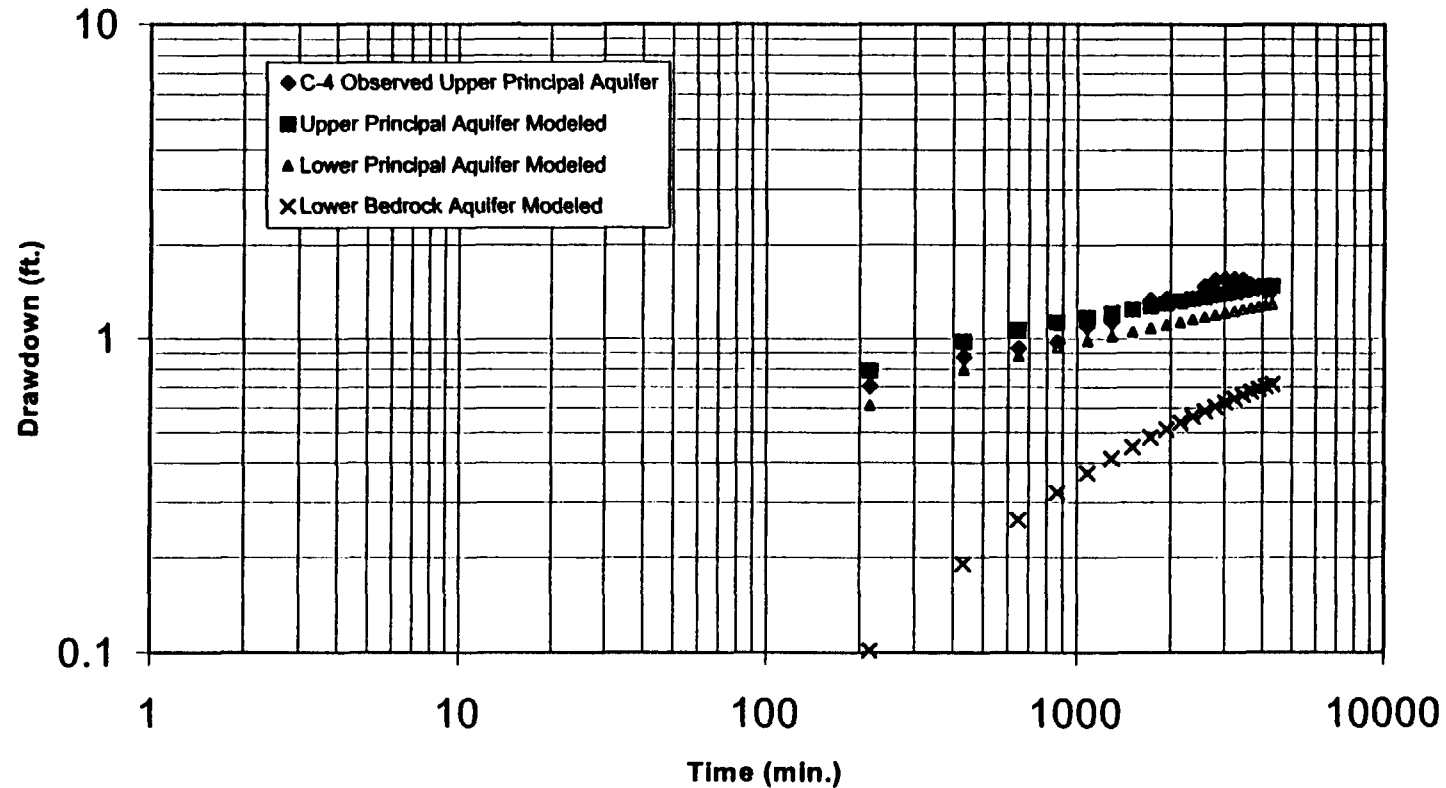
Nashville, Tennessee
Mahwah, New Jersey

200 0 200 400
scale feet

NOTE:
POTENTIOMETRIC CONTOURS BASED ON HEAD
MEASUREMENT COLLECTED ON AUGUST 29, 1994.

10.0190





NOTE:

PUMPING C-1 @ 22 GPM

FIGURE A3-7
 MODELED (VS) AQUIFER TEST
 DRAWDOWN C-4

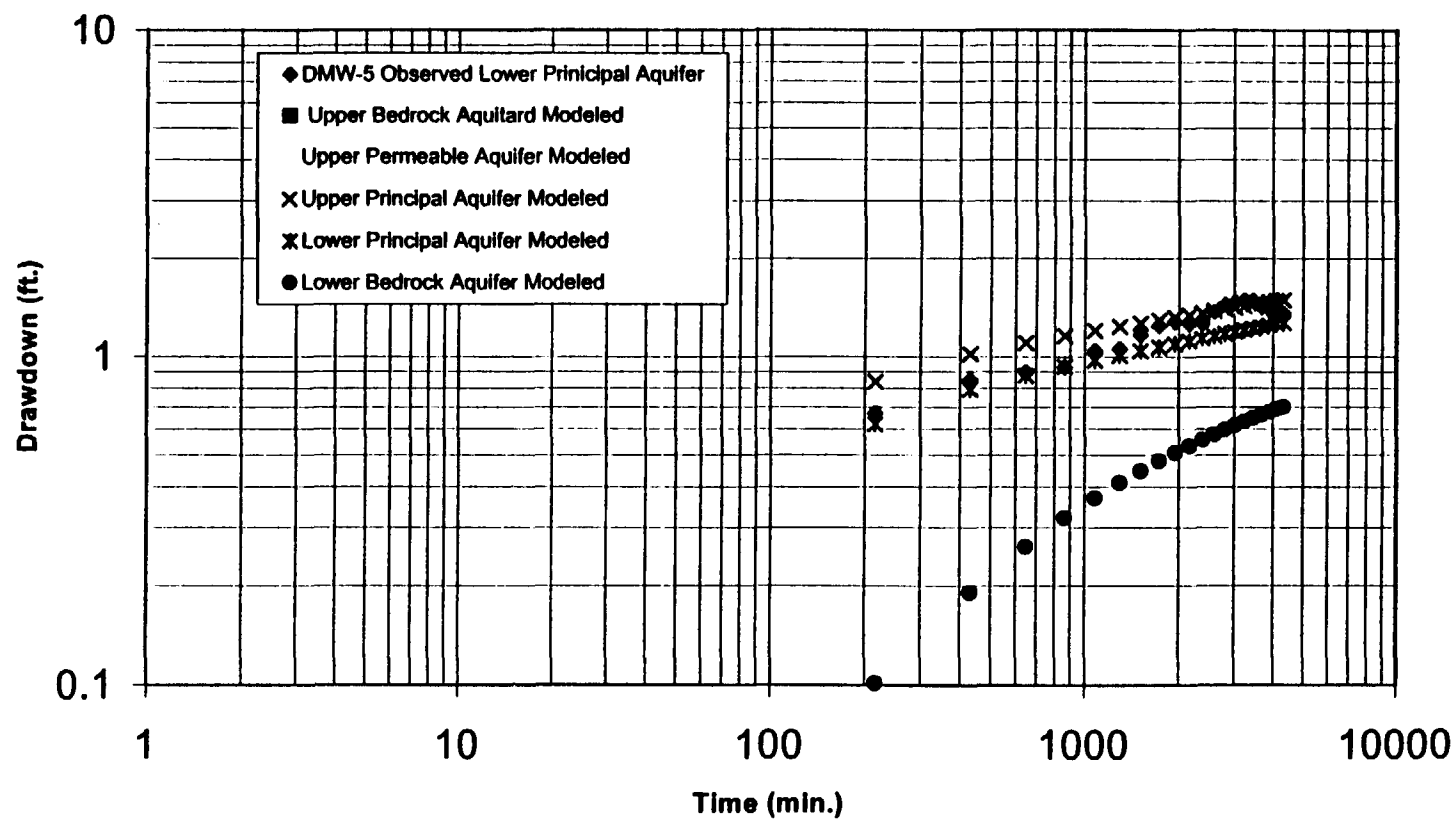
CHEMSOL INC. SUPERFUND SITE
 UPPER PERMEABLE AQUIFER



ECKENFELDER INC.

Nashville, Tennessee
 Mahwah, New Jersey

100192



NOTE:

PUMPING C-1 @ 22 GPM

FIGURE A3-8

**MODELED (VS) AQUIFER TEST
DRAWDOWN DMW-5**

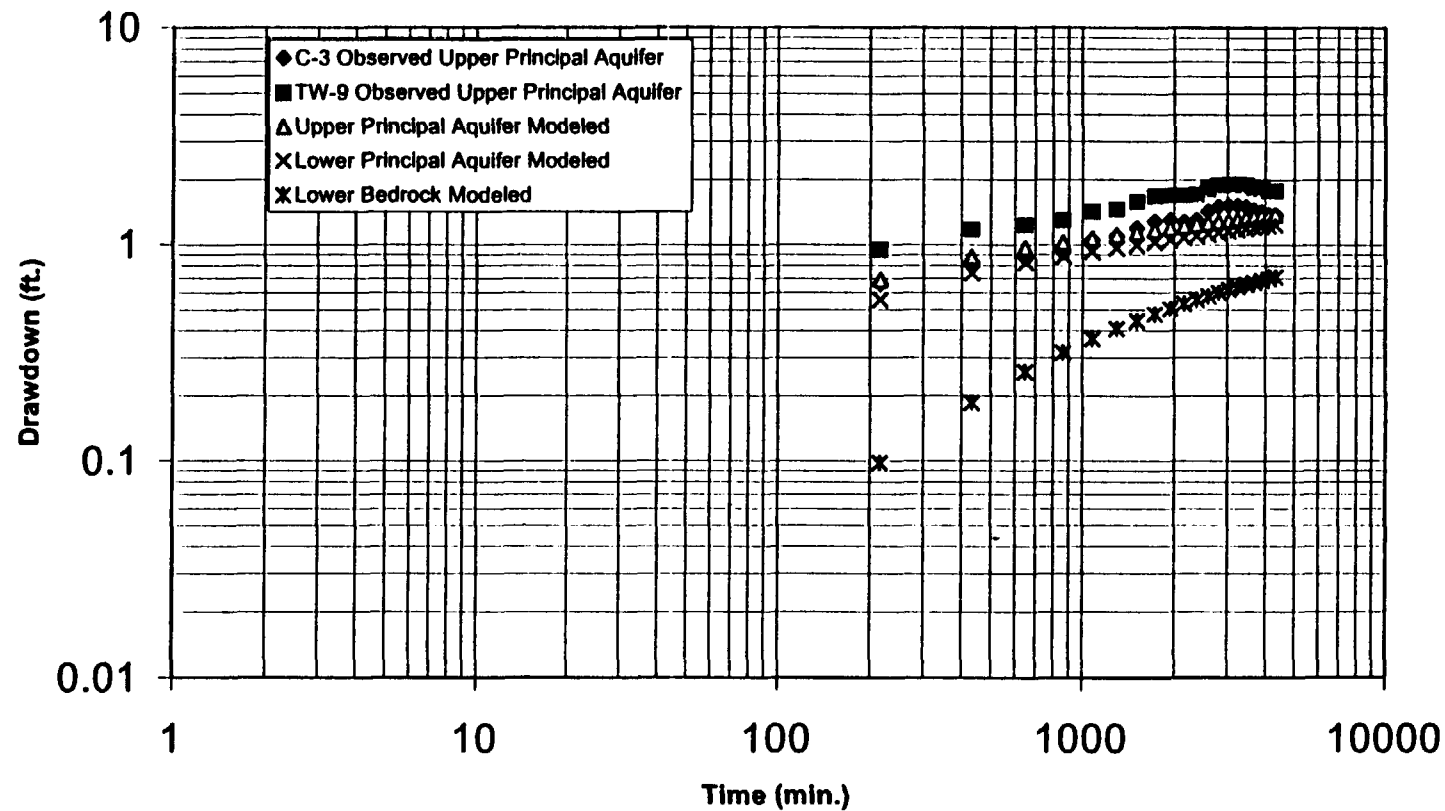
**CHEMSOL INC. SUPERFUND SITE
UPPER PERMEABLE AQUIFER**



ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

100193



NOTE:

PUMPING C-1 @ 22 GPM

100194

FIGURE A3-9

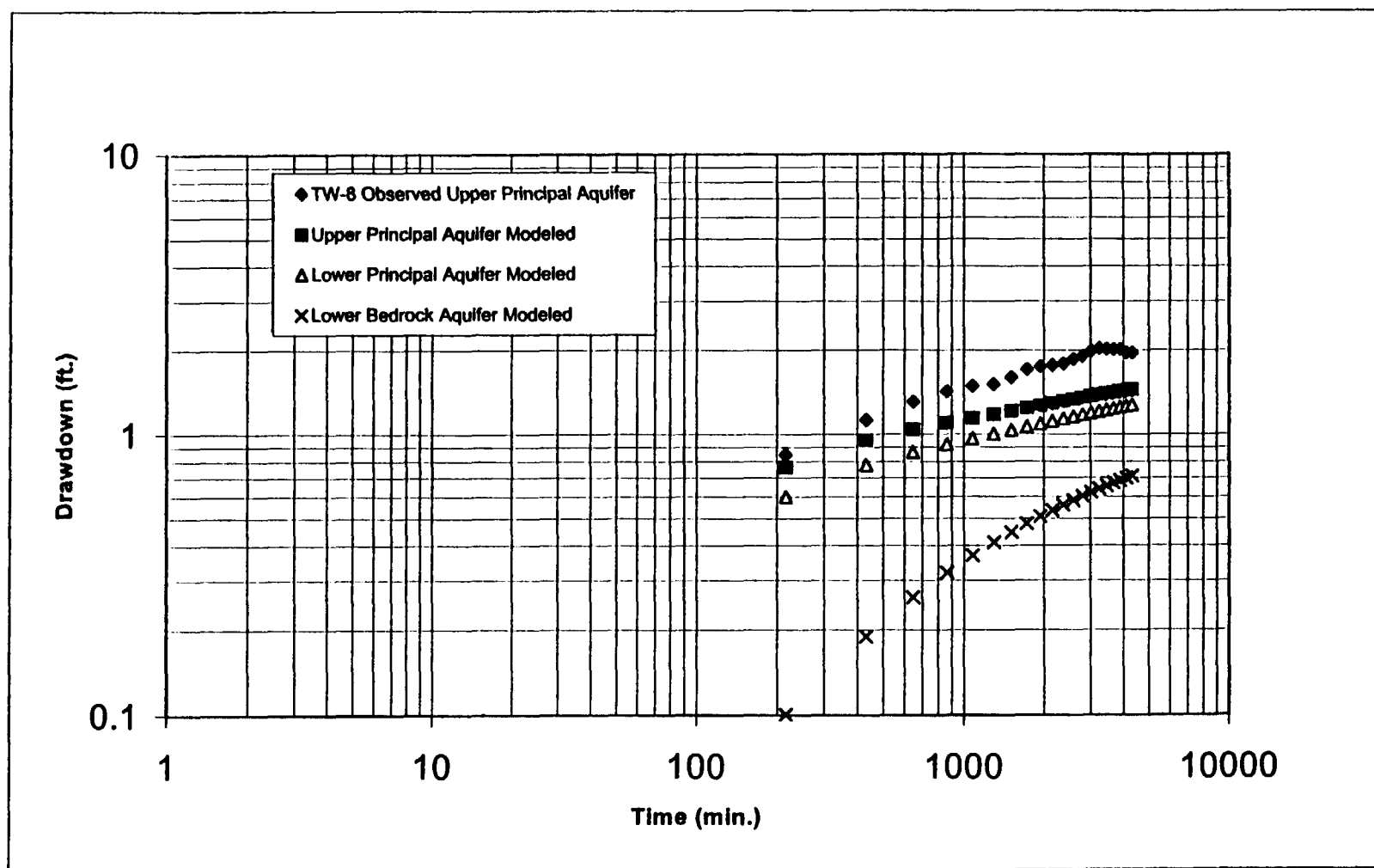
**MODELED (VS) AQUIFER TEST
DRAWDOWN C-3 & TW-9**

**CHEMSOL INC. SUPERFUND SITE
UPPER PERMEABLE AQUIFER**



Nashville, Tennessee
Mahwah, New Jersey

ECKENFELDER INC.



NOTE:

PUMPING C-1 @ 22 GPM

FIGURE A3-10

MODELED (VS) AQUIFER TEST
DRAWDOWN TW-8

CHEMSOL INC. SUPERFUND SITE
UPPER PERMEABLE AQUIFER



ECKENFELDER INC.

Nashville, Tennessee
Mahwah, New Jersey

10.0195

**TABLE A3-1
CHEMSOL INC. SITE GROUNDWATER MODEL
CALIBRATION STATISTICS**

Well ID	Measured Head (ft.)	Modeled Head (ft.)	Residual (ft.)
Upper Bedrock Aquitard			
TW-3	59.56	59.14	0.42
TW-4	59.37	59.06	0.31
TW-2	59.98	59.28	0.7
Upper Permeable Aquifer			
C-7	59.1	58.78	0.32
C-8	59.32	59.01	0.31
C-10	59.11	58.9	0.21
C-6	59.21	58.71	0.5
C-9	59.41	59.12	0.29
Upper Principal Aquifer			
DMW-10	58.42	58.53	-0.11
DMW-9	58.18	58.43	-0.25
C-1	58.5	58.74	-0.24
C-5	58.37	58.84	-0.47
TW-6	58.76	58.78	-0.02
TW-8	59.15	58.93	0.22
C-4	58.2	58.92	-0.72
TW-13	59.76	58.59	1.17
C-3	58.39	58.88	-0.49
Lower Principal Aquifer			
MW-103	58.3	58.7	-0.4
DMW-5	58.28	58.67	-0.39
DMW-6	58.21	58.69	-0.48
DMW- 7	58.32	58.77	-0.45
DMW-1	58.36	58.91	-0.55
Lower Bedrock Aquifer			
DMW-8	57.82	58.62	-0.8
MW-101	58.02	58.69	-0.67
DMW-2	57.83	58.85	-1.02
MW-102	57.81	58.72	-0.91
DMW-4	57.86	58.8	-0.94
DMW-3	58.36	58.79	-0.43
Average of Absolute Residual =			0.477
Sum of Residual =			-4.89

10.0196

aquifer test by pumping C-1 at approximately 22.5 gpm for 72 hours. The transient calibration was completed by comparing measured drawdown to modeled drawdown. Figures A3-7 through A3-10 present the comparison of measured versus modeled drawdown for the available data from the Principal Aquifer. These plots illustrate that the predicted drawdown tracks close to the observed drawdown in each of the observation wells.

The calibrated model parameters are presented on Table A3-2.

A3.6 MODEL SENSITIVITY ANALYSIS

A sensitivity analysis was performed to identify the relative importance of the various parameters and to evaluate the degree to which the base case represents a unique solution. The analysis was performed by changing the value of one input parameter at a time and comparing the results (head residuals) to the base case simulation. The sum of the residuals and the average absolute residual were calculated for each sensitivity run and compared to the corresponding values for the base case simulation. To provide a standard point of comparison, each input parameter value was increased (and decreased) until a change of at least 10 percent of the average absolute residual was observed.

The input parameters that were evaluated are shown in the first column of Table A3-3. The "factor" represents the direction and magnitude of the change from the base case value. The results indicate that the least sensitive parameters are the leakance values between the layers. For these parameters, changes of at least an order of magnitude were required to alter the base case match by 10 percent. The most sensitive parameters were the transmissivity of the Upper Principal Aquifer and effective recharge. Altering the base case value of transmissivity by a factor of less than 2x achieved the 10 percent criterion for change. (Although an increase in the transmissivity indicates a slightly better match than the base case values, these higher values did not produce an acceptable match with the drawdown data when used to simulate the aquifer test.) These results are generally consistent with our conceptual model in that the most permeable unit typically controls the elevation of water levels and thus the direction of groundwater flow.

**TABLE A3-2
CALIBRATION PARAMETER
CHEMSOL GROUNDWATER MODEL**

Water-bearing Zone	Model Layer	Model Parameter	Value
Upper Aquitard	Layer 1	Hydraulic Conductivity	2.5 ft/day
Upper Permeabel Aquifer	Layer 2	Transmissivity	878 ft ² /day
Upper Principal Aquifer	Layer 3	Transmissivity	849 ft ² /day
Lower Principal Aquifer	Layer 4	Transmissivity	849 ft ² /day
Lower Bedrock Aquifer	Layer 5	Transmissivity	1710 ft ² /day
Upper Bedrock Aquitard	Layer 1/Layer 2	Leakance	1.0 e ⁻³ /day
Upper Gray Marker Unit	Layer 2/Layer 3	Leakance	1.4 e ⁻⁵ /day
Lower Gray Marker Unit	Layer 4/Layer 5	Leakance	6.5 e ⁻⁴ /day
-	-	Recharge	0.7/2 in/year ^a

^a - Indicates Arial recharge and recharge over the subcrop areas.

100198

**TABLE A3-3
SENSITIVITY ANALYSIS
CHEMSOL GROUNDWATER MODEL**

Water-bearing Zone	Model Parameter	Base Case Value Factor	Sensitivity Value Factor	Sensitivity Analysis		Base Case	
				Average Absolute Residual (ft)	Sum of Residual (ft)	Average Absolute Residual (ft)	Sum of Residual (ft)
Upper Aquitard	Hydraulic Conductivity Layer 1	2.5 ft/day	12.5 ft/day x5	1.09	15.97	0.47	-4.89
Upper Aquitard	Hydraulic Conductivity Layer 1	2.5 ft/day	0.5 ft/day /5	0.64	-15.32	0.47	-4.89
Upper Permeable Aquifer	Transmissivity Layer 2	878 ft ² /day	1756 ft ² /day x2	0.75	3.61	0.47	-4.89
Upper Permeable Aquifer	Transmissivity Layer 2	878 ft ² /day	220 ft ² /day /4	0.72	-17.69	0.47	-4.89
Upper Principal Aquifer	Transmissivity Layer 3	849 ft ² /day	1953 ft ² /day x2	0.36	0.92	0.47	-4.89
Upper Principal Aquifer	Transmissivity Layer 3	849 ft ² /day	340 ft ² /day /2	0.59	-9.89	0.47	-4.89
Lower Principal Aquifer	Transmissivity Layer 4	849 ft ² /day	1953 ft ² /day x2	0.35	1.29	0.47	-4.89
Lower Principal Aquifer	Transmissivity Layer 4	849 ft ² /day	340 ft ² /day /2.5	0.61	-10.37	0.47	-4.89
Lower Bedrock Aquifer	Transmissivity Layer 5	1710 ft ² /day	8550 ft ² /day x5	0.37	9.39	0.47	-4.89
Lower Bedrock Aquifer	Transmissivity Layer 5	1710 ft ² /day	342 ft ² /day /5	1.12	-27.85	0.47	-4.89
Upper Aquitard	Leakance Layer 1/2	1.0 e ⁻³ /day	1.0 e ⁻² /day x10	0.53	-3.29	0.47	-4.89
Upper Aquitard	Leakance Layer 1/2	1.0 e ⁻³ /day	1.0 e ⁻⁴ /day /10	0.56	-12.92	0.47	-4.89
Upper Gray Marker Unit	Leakance Layer 2/3	1.4 e ⁻⁵ /day	1.0 e ⁻⁴ /day x10	0.48	-0.76	0.47	-4.89
Upper Gray Marker Unit	Leakance Layer 2/3	1.4 e ⁻⁵ /day	1.0 e ⁻⁶ /day /10	0.52	-6.27	0.47	-4.89
Lower Gray Marker Unit	Leakance Layer 4/5	6.5 e ⁻⁴ /day	6.5 e ⁻³ /day x10	0.49	-5.76	0.47	-4.89
Lower Gray Marker Unit	Leakance Layer 4/5	6.5 e ⁻⁴ /day	6.5 e ⁻⁵ /day /10	0.48	-6.67	0.47	-4.89
-	Recharge	0.7/2 in/year ^a	2/5 in/year x2.5	3.89	-108.91	0.47	-4.89
-	Recharge	0.7/2 in/year	.4/1 in/year /2	0.89	23.74	0.47	-4.89

^a - Indicates Areal recharge and recharge over the subcrop areas.

Recharge was also a sensitive parameter in that a change of approximately 30 percent met the sensitivity criterion of 10 percent of the average absolute residual. This suggests that heads within the bedrock will respond quickly to precipitation events, but that the effects will be relatively short lived.

A4.0 CAPTURE ZONE SIMULATIONS

The development and calibration of the groundwater flow model for the Site not only provides a tool to predict the impact of future events, but also supports and ties together the conclusions derived from the quantitative hydrogeologic analysis (see Attachment A). Based on the model calibration and sensitivity analysis described in Sections A3.4 and A3.5, the calibrated base case groundwater flow model developed for the Chemsol Inc. Site provides a reasonable representation of the existing hydrogeologic conditions. In this section, the calibrated model is used to develop and evaluate extraction simulations for the groundwater remedy.

A4.1 EXTRACTION SCENARIOS

Extraction of groundwater and treatment has been selected by USEPA as the remedy for the Site. Some of the objectives of this remedy are to:

- Prevent/minimize off-site migration of groundwater contamination in the fractured bedrock aquifer.
- Contain the contaminated groundwater (that which is above Federal and State MCLs) from all depth zones and, as an element of this containment, reduce the mass of contaminants to the maximum extent possible.
- Augment the existing interim remedy, as necessary, in order to achieve these goals.

To design an extraction system to satisfy these objectives, the groundwater flow model was used to predict the effects of pumping from the bedrock aquifer system. A number of simulations were completed as part of this process. Based on this evaluation two scenarios are presented. In Scenario 1 the objective was to optimize the location and pumping rate of extraction wells to achieve the containment criteria. In Scenario 2, the objective was to locate extraction wells that would achieve the containment criteria and pump from the portions of the site that have historically shown elevated levels of groundwater contamination. A detailed discussion of these scenarios follows:

EXTRACTION SCENARIO 1

Extraction Scenario 1 provides a scenario in which containment is achieved within the contaminated portion of the site. This scenario includes the existing interim remedy extraction well C-1 pumping at 15 gpm and the addition of extraction wells EX-1 (Upper Permeable Aquifer) and EX-2 (Lower Bedrock Aquifer) pumping at 5 gpm each. The total extraction rate of this scenario is estimated to be 25 gpm. A particle tracking routine (MODPATH) was used to demonstrate capture within the individual aquifers. To simplify the particle tracking plots, the outline of the capture zone has been presented. Capture with the Principal Aquifer is presented on Figure A4-1. The capture zone developed is as result of pumping C-1 at a rate of 15 gpm. As shown, the developed capture zone encompasses the estimated area of groundwater contamination with in the principal aquifer.

Figure A4-2 shows the capture zone developed by pumping Extraction well EX-1 at 5 gpm within the Upper Permeable Aquifer. This scenario demonstrates that a low extraction rate within the Upper Permeable Aquifer can effectively capture the contaminated groundwater associated with this zone.

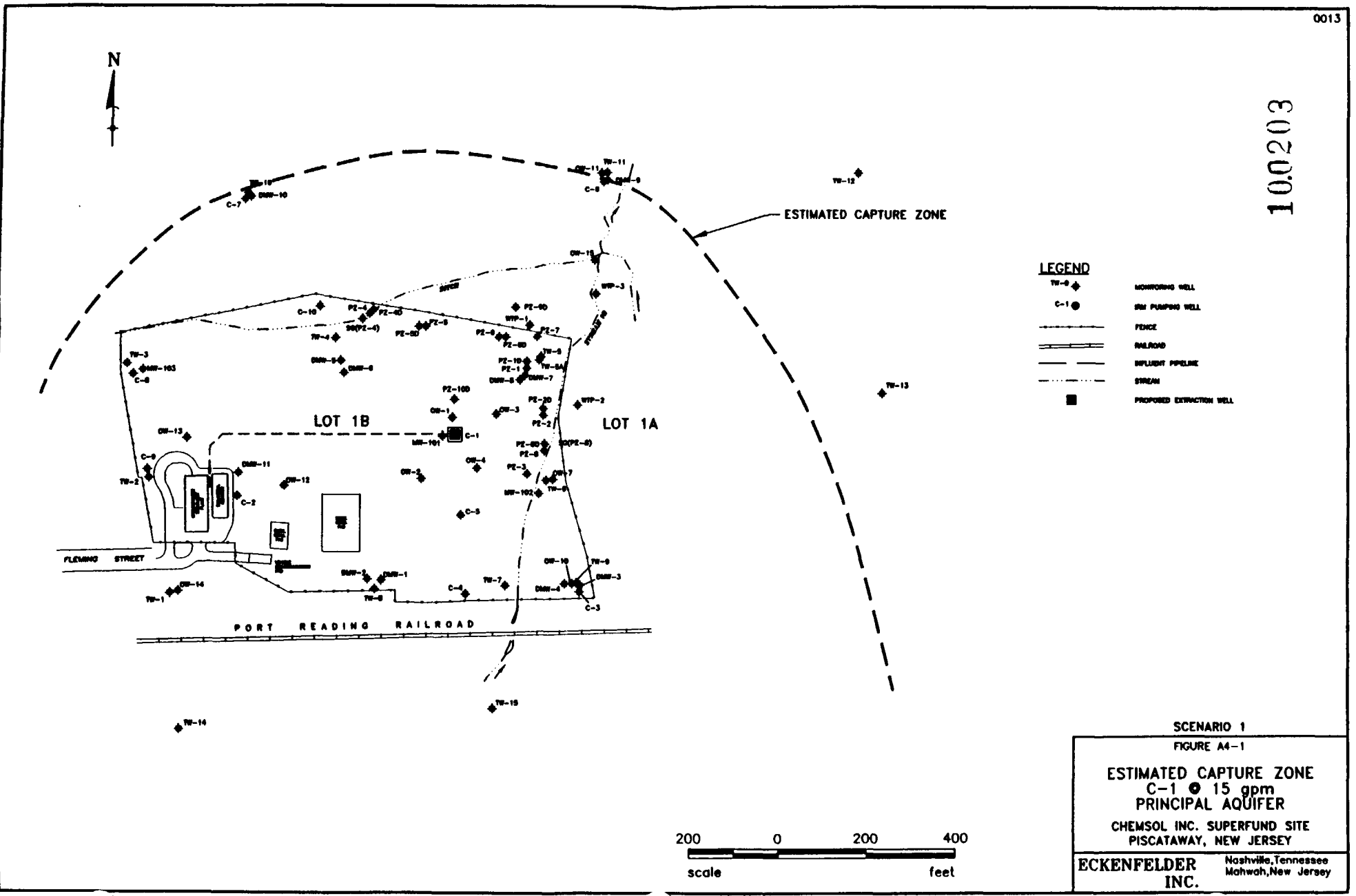
Figure A4-3 shows the capture zone developed by pumping Extraction well EX-2 at 5 gpm within the Lower Bedrock Aquifer. Although the extent of contamination is not well defined within the Lower Aquifer, the capture zone developed by extraction well EX-2, captures an area which is believed to encompass the potentially impacted area.

EXTRACTION SCENARIO 2

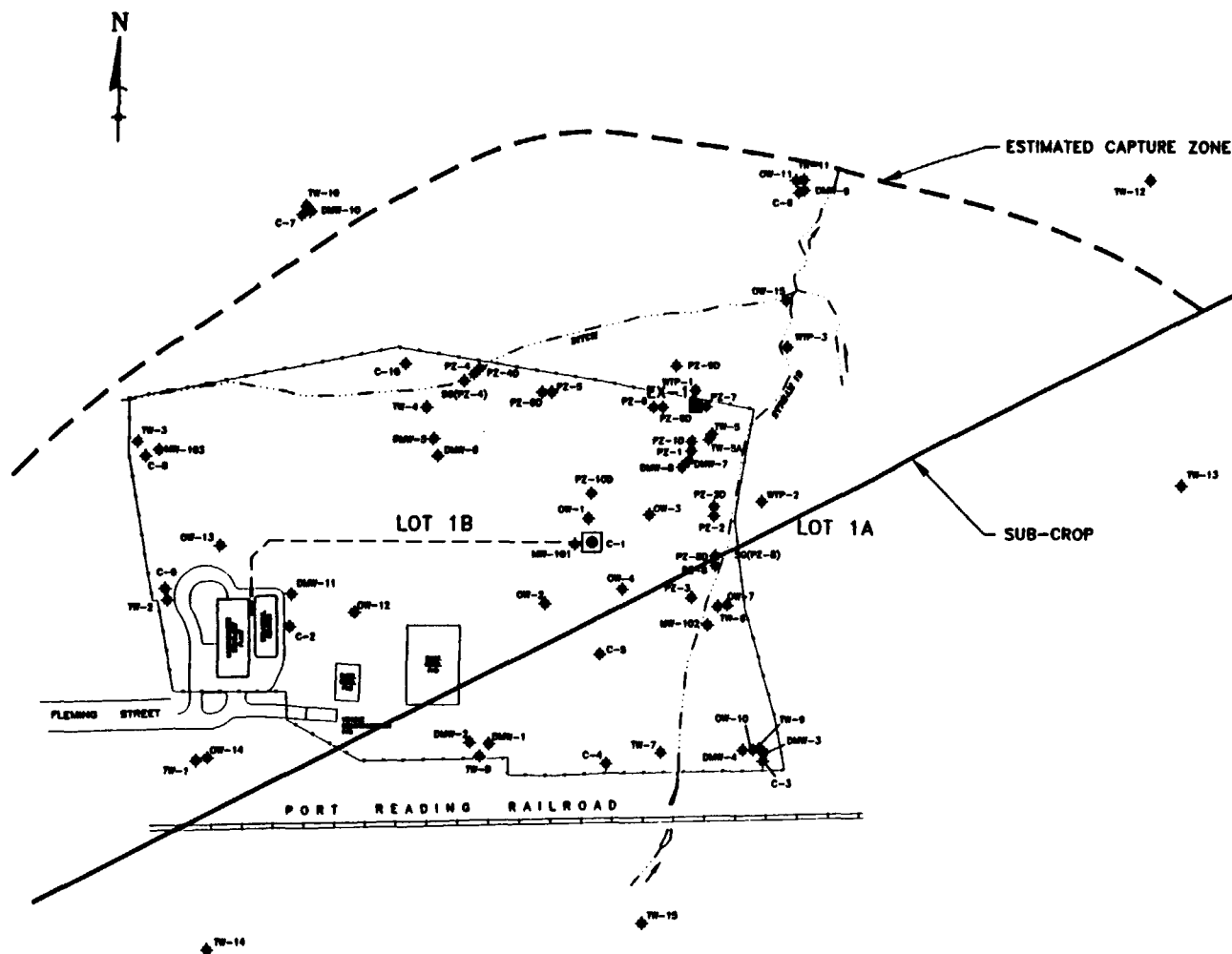
Extraction Scenario 2 provides a scenario in which containment objective is achieved and mass removal is enhanced within the Upper Bedrock Aquitard. This scenario includes the wells and pumping rates presented in Scenario 1 with the addition of two Upper Bedrock Aquitard wells EX-3 and EX-4. These Upper Aquitard wells are simulated to pump at 1 gpm each, for a total extraction rate for Scenario 2 of 27 gpm. Figure A4-4 presents the location of EX-3 and EX-4 and the estimated capture zone.

100203

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100204



LEGEND

- TW-9 ◆ MONITORING WELL
- C-1 ● OW PUMPING WELL
- FENCE
- RAILROAD
- INFLUENT PIPELINE
- STREAM
- EX-1 PROPOSED EXTRACTION WELL

SCENARIO 1

FIGURE A4-2

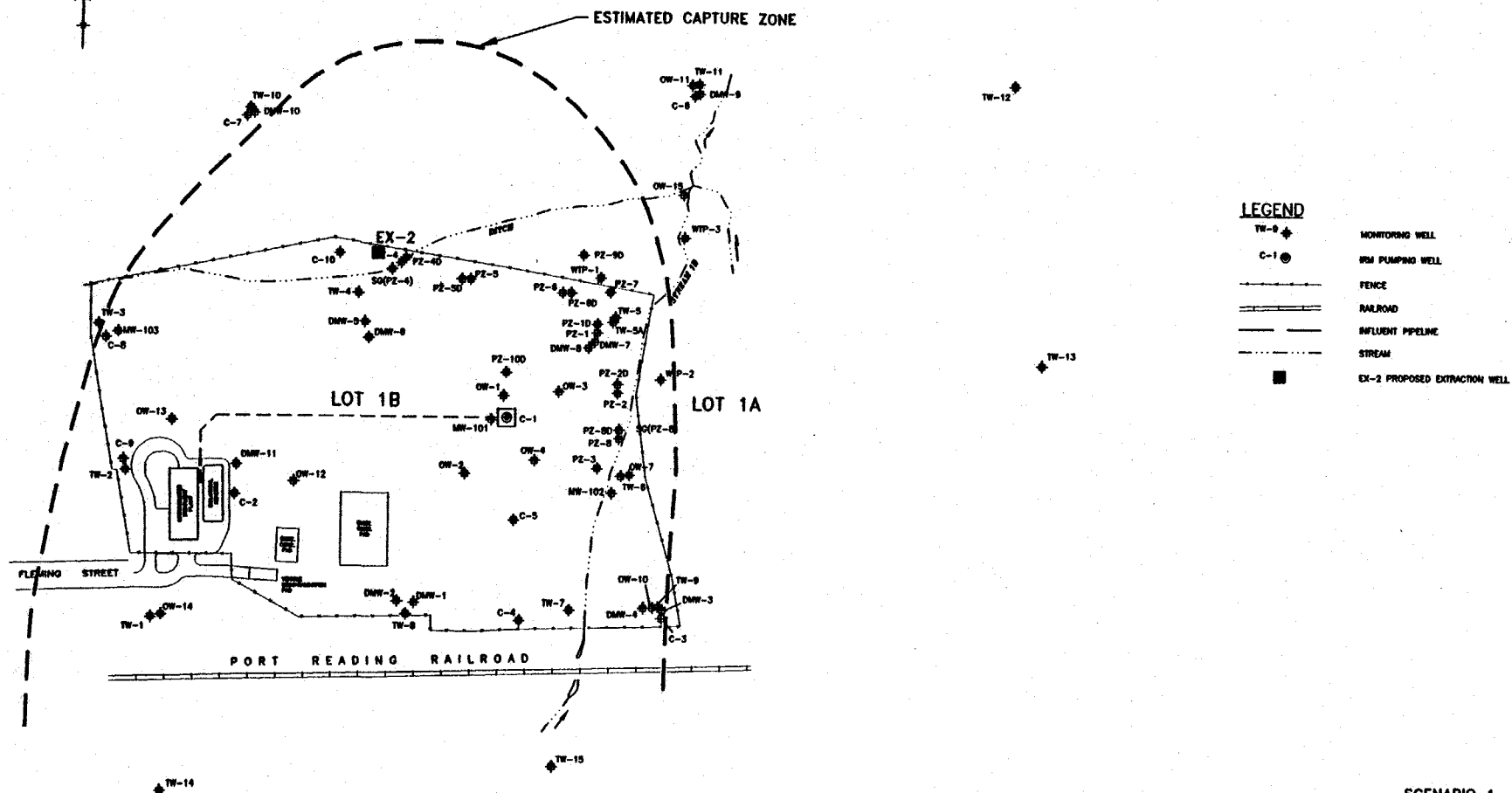
ESTIMATED CAPTURE ZONE
 1 WELL @ 5 gpm
 UPPER PERMEABLE AQUIFER
 CHEMSOL INC. SUPERFUND SITE
 PISCATAWAY, NEW JERSEY

ECKENFELDER
 INC.

Nashville, Tennessee
 Mahwah, New Jersey

200 0 200 400
 scale feet

100205



SCENARIO 1

FIGURE A4-3

ESTIMATED CAPTURE ZONE
 1 WELL @ 5 gpm
 LOWER BEDROCK AQUIFER

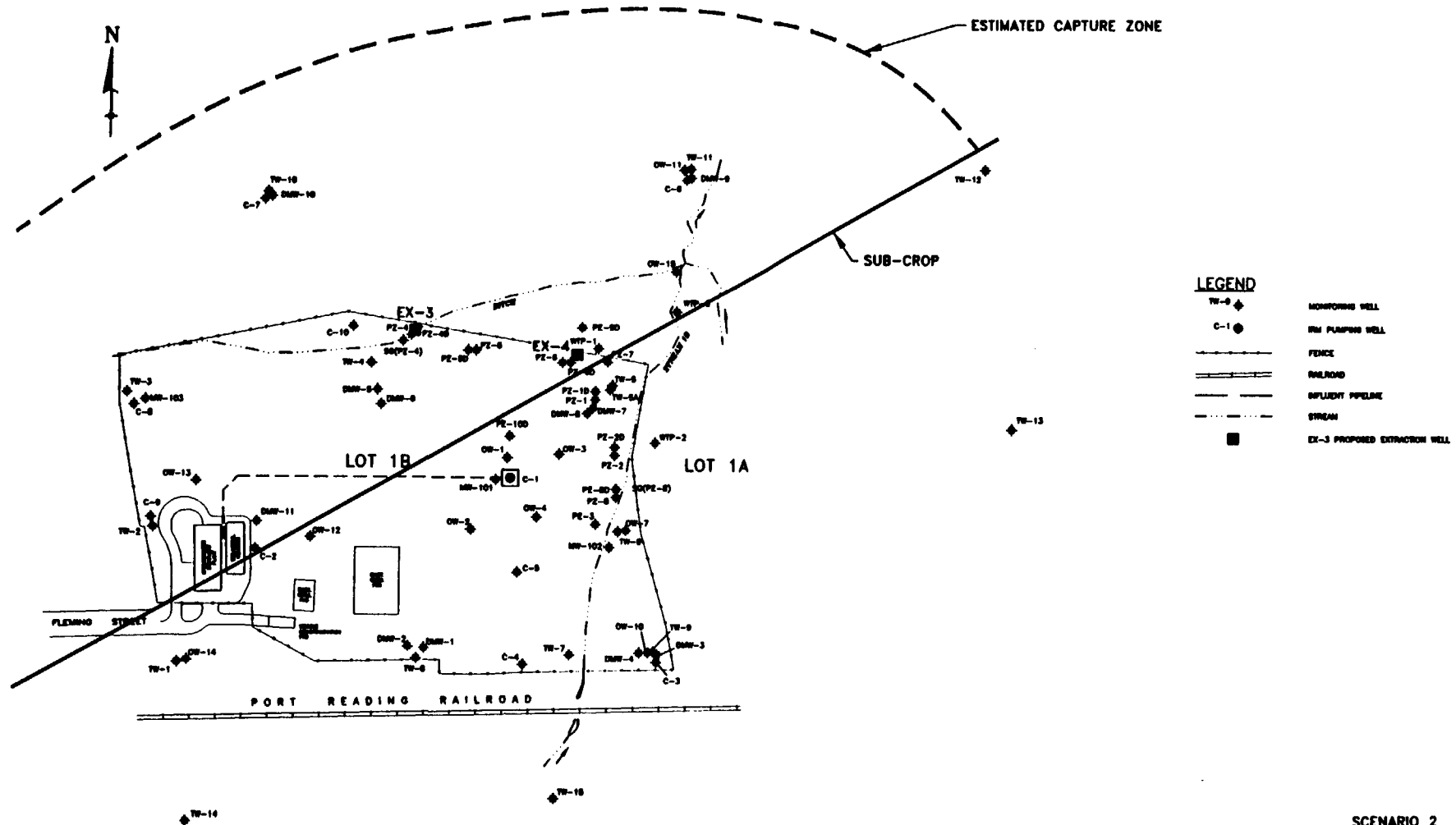
CHEMSOL INC. SUPERFUND SITE
 PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
 Mohwah, New Jersey

200 0 200 400
 scale feet

100206



SCENARIO 2

FIGURE A4-4

ESTIMATED CAPTURE ZONE
PUMPING 2 WELLS @ 1 gpm EA.
UPPER AQUITARD

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey

200 0 200 400
scale feet

A4.2 MODEL LIMITATIONS

The groundwater flow model developed for the Chemsol Site provides a reasonably accurate representation of the hydrogeologic conditions and groundwater flow processes in the project area. However, by definition, all models are approximations or simplifications of the real system (Anderson, 1991). They cannot simulate the small-scale variations in soil or rock properties such as local changes in hydraulic conductivity and thickness, or the presence of individual fractures. As a result, the natural heterogeneity of the subsurface materials is manifested in a degree of uncertainty in the model results. The magnitude of the uncertainty will vary both spatially within the model domain, and with respect to the intended use. For example, the uncertainty relative to bedrock hydraulic conductivity is much greater at the model boundaries than within the vicinity of the site proper. Thus, the model's ability to predict the response of the groundwater flow system to pumping will be most accurate near the site, and progressively less accurate downgradient.

For this project, one of the primary objectives of the model was to evaluate the location of extraction wells and predict the pumping rate necessary to achieve containment. The simulated extraction wells shown on Figures A4-1 through A4-4 are located on site, and in close proximity to the stresses imposed by the pumping of well C-1, which were successfully reproduced by the model during calibration. Thus, based on this close proximity of measured and predicted stresses, and the results of the sensitivity analysis, a model uncertainty of plus or minus 30 percent is estimated and has been applied to the model predictions. Therefore, the total extraction rate for Scenario 1 required to maintain the capture zones predicted in Figures A4-1, A4-2, and A4-3 is expected to be within the range of approximately 17.5 gpm to 32.5 gpm. The total pumping rate for Scenario 2 is estimated to range from 19 to 35 gpm.

ATTACHMENT A

**QUANTITATIVE ANALYSIS OF THE
HYDROGEOLOGIC SYSTEM**

100208

ATTACHMENT A

QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM

A quantitative analysis of the available hydrogeologic data has been conducted for the Chemsol Site. This analysis included a review of data from the RI as well as a revisit of data by AGES and McLaren/Hart to determine if additional information could be extracted from their efforts. The available data include aquifer test, slug test, and packer testing data.

This evaluation provides as much of a quantitative understanding of the hydrogeologic system as is reasonably feasible given the complex hydrogeologic system. By the term "quantitative understanding", we mean the ability to subdivide the hydrogeologic system into functional hydrostratigraphic units and assign hydrogeologic properties to these units, such as transmissivity, hydraulic conductivity, and storativity. This type of quantitative understanding of the system will be vital as a foundation for the numerical modeling of the system, even if the properties are modified (as they almost certainly will be) during the calibration of the model.

PRE-RI PUMP TESTING

In 1987, AGES Corporation performed a hydrogeologic assessment of the Chemsol site. As part of their work, they conducted a step-drawdown test of Well C-1, and a subsequent aquifer test using the same well. Extraction of much usable hydrogeologic data from the AGES work is problematic since the aquifer test at Well C-1 was begun shortly after the conclusion of the step-drawdown test and before sufficient time had elapsed for the aquifer to fully recover from the drawdown produced by the step-drawdown test.

In 1993, McLaren/Hart conducted a hydrogeologic study of the Chemsol site. As part of their work, they performed an aquifer test using Well C-1 as the pumping well and a number of wells as monitoring points. While procedurally, the work of McLaren/Hart is a considerable improvement over the earlier AGES work, analysis of the data from the aquifer test is hindered by the fact that the open interval of Well C-1 actually spans two distinct water-bearing zones and an intervening hydrostratigraphic unit (the Gray Shale), which generally acts as an aquitard. This

was not recognized in 1993. Consequently, the well likely draws an indeterminate amount of water from each zone, thus confounding precise definition of the hydrogeologic properties of either zone. However, some useful data can be drawn from this test since apparently most of the water is drawn from the Principal Aquifer.

INITIAL OBSERVATIONS

Before embarking upon an in-depth assessment of the aquifer tests, slug tests, and packer tests, several general observations are made about the hydrogeologic system as a conceptual foundation for the subsequent analyses:

1. The observed vertical hydraulic head losses at the site are indicative of moderate to low vertical hydraulic conductivity in some zones.
2. The above observation, coupled with the relatively high yields observed in various pumping wells and packer tests, suggests a hydrogeologic system composed of interlayered aquifers and aquitards.
3. Vertical anisotropy is also indicated on a system-wide basis and probably within individual strata as well.
4. A degree of heterogeneous hydrogeologic behavior is evident in virtually all the data. This heterogeneity significantly complicates the effort to precisely model the system. Nonetheless, the generalized behavior of the system should be subject to modeling and reasonably accurate predictive analysis.
5. The heterogeneity has particular implications to the implementation of a groundwater extraction system at the site. No matter how thoroughly one probes the hydrogeologic data for insight into the properties of the system or how diligently one strives to calibrate a numerical groundwater flow model based on those calculated properties, performance of a groundwater extraction system will require careful verification. It is likely that the Observational Method, in one form or another, will have to be utilized to design and construct a cost-effective system.

10.0210

ANALYSIS OF THE HYDROGEOLOGIC DATA

In analyzing the hydrogeologic system at the Chemsol site, principal emphasis has been placed upon the aquifer test and packer test conducted by CDM and McLaren/Hart. In particular, CDM conducted a packer test of some duration, which they termed the long-term test. This packer test was, in essence, an aquifer test and the data from this packer test are quite useful. The aquifer test conducted by McLaren/Hart in 1993 of Well C-1 is also useful. ECKENFELDER INC. has carefully evaluated all of the packer test data to see what quantitative information can be extracted from this considerable body of data. While the packer tests were primarily conducted to determine the interconnectedness of various zones, nonetheless, some of the tests lend themselves to quantitative analysis.

The packer test data were first evaluated as to whether analyses could be conducted using the Theis type curve match technique on the drawdown data. Analysis of the drawdown data, however, was not feasible due to the variable pumping rate employed in the early phase of the packer test. In most cases, the flow rate during the packer test was increased in step-wise fashion during the early part of the test, and then held relatively constant throughout the remainder of the test. While the early stepped pumping rate makes time-drawdown analysis infeasible, analysis of time-recovery data is possible since water level recoveries react more to the average pumping rate, particularly during the later phases of the test, than they do to early fluctuations in pumping rate. Distance drawdown analyses were also employed to analyze the drawdown at the conclusion of the packer test pumping. Lastly, packer test recovery data were also used to conduct Neuman-Witherspoon ratio method analyses of the upper bedrock zone above the upper permeable zone. Each of these methods of analysis is briefly described below. A summary of the results of the aquifer test analyses is presented in Table 1.

Long-Term Test of CDM

CDM performed what they termed the "Long-Term Test" as part of their packer testing activities. During the long-term test, drawdown was measured in a number of monitoring wells, and the results analyzed by CDM using the AQTESOLV® computer program. Three tests, in particular, provide insight into the

TABLE 1
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-1	CDM	14,500	2.1×10^{-4}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-5	CDM	8,800	7.8×10^{-5}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - MW-103	CDM	8,800	2.2×10^{-4}	---
Principal Aquifer	Packer Test: Round 3, Test 2 Distance - Drawdown Analysis	ECKENFELDER INC.	>5,000	2.3×10^{-4}	---
Principal Aquifer	Neuman-Witherspoon Ratio method Analysis of McClaren-Hart Aquifer Test	ECKENFELDER INC.	---	---	3.5×10^{-4}

100212

TABLE 1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match TW-9	McClaren-Hart	8,500	9.9×10^{-5}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match DMW-5	McClaren-Hart	10,300	4.1×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-3	McClaren-Hart	10,800	1.7×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-4	McClaren-Hart	10,800	1.9×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-5	McClaren-Hart	29,000	2.1×10^{-4}	---
Upper Permeable Aquifer	Packer Test: Theis Type Curve Match of time-recovery data Round 3, Test 3, Well C-6	ECKENFELDER INC.	12,300	1×10^{-4}	---

100213

TABLE 1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Upper Permeable Aquifer	Packer Test: Distance-Drawdown Analysis of Round 3, Test 3	ECKENFELDER INC.	13,000	6×10^{-6}	---
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-8, TW-3	ECKENFELDER INC.	---	---	1.1×10^{-4}
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-10, TW-4	ECKENFELDER INC.	---	---	6.5×10^{-5}

100214

transmissivity and storativity of the principal aquifer. These tests are the analyses conducted based upon the drawdowns observed in Wells DMW-1, DMW-5 and MW-103. These particular wells are well suited stratigraphically to determine the aquifer parameters. The results of CDM's analyses are presented in Table 1.

Distance Drawdown Analyses of Packer Test Round 3, Test 2

Efforts were undertaken by ECKENFELDER INC. to determine whether any of the packer test data would be suitable for a distance drawdown analyses using the Cooper-Jacob method. This methodology is particularly useful in defining transmissivity. However, most of the packer tests do not lend themselves to this type of analysis for two reasons. First, there are generally not a sufficient number of wells at different radial distances from the pumped interval to define the shape of the distance drawdown curve. Secondly, the pumped interval typically cannot be used in the analysis because of excessive well losses. Nonetheless, one packer test, specifically Round 3, Test 2, provided some insight into the transmissivity in that well losses in the pumped interval in Well DMW-10 appeared to be more modest. Drawdown in the pumped interval was only 4.8 feet (compared to many tens of feet in some of the other packer tests). An analysis of this packer test using the Cooper-Jacob distance drawdown method, and assuming the drawdown in the pumped interval is reflective of actual drawdown in the formation, yields a transmissivity of 5,000 gallons per day per foot and a storativity of 2.3×10^{-4} . In all likelihood the transmissivity is higher than this figure since well losses likely occur. For example, if well losses accounted for one-half of the observed drawdown, the transmissivity would be approximately 10,000 gallons per day per foot. The plot of the data and the associated calculations are provided in Attachment B-1.

Aquifer Test of Well C-1 by McLaren/Hart

McLaren/Hart conducted an aquifer test of Well C-1 measuring drawdown in a number of monitoring wells. The analyses of the drawdowns observed in Wells TW-9, DMW-5, C-3, C-4, and C-5 are particularly appropriate as these wells are well positioned stratigraphically to define the aquifer parameters of the principal aquifer. These analyses, which are presented in McLaren/Hart's report, yielded transmissivities ranging from 8,500 to 29,000 gallons per day per foot and storativities ranging from 9.9×10^{-5} to 4.1×10^{-4} , as presented in Table 1.

As mentioned earlier, the aquifer test conducted by McLaren/Hart of Well C-1 is limited in its accuracy due to the fact that the well is likely pumping an indeterminate amount of water from both the principal aquifer and the upper permeable zone. However, based upon the results of the analyses and a comparison to more recent aquifer tests conducted by CDM, it is likely that the majority of the water being pumped from Well C-1 is being drawn from the principal aquifer. Consequently, it can be concluded that the calculated transmissivity is reasonably reflective of the Principal Aquifer.

Neuman-Witherspoon Ratio Method Analysis of McLaren/Hart Aquifer Test

In order to gain some insight into the vertical hydraulic conductivity of the principal aquifer, ECKENFELDER INC. conducted a Neuman-Witherspoon Ratio Method Analysis of the data from the McLaren/Hart Aquifer Test. A vertical hydraulic conductivity of 3.5×10^{-4} centimeters per second was estimated for the lower portion of the principal aquifer. These data and associated calculations are presented in Attachment B-2.

Theis Type Curve Matching of Time Recovery Data from Packer Test

ECKENFELDER INC. conducted Theis type curve analysis of recovery data from a number of the packer tests. One test in particular generated data permitting a Theis type curve match analysis. These data were the packer test recovery data from Round 3, Test 3 for Well C-6. This analysis permits estimation of the aquifer parameters of the upper permeable zone. The analysis resulted in an estimated transmissivity of 12,300 gallons per day per foot and a storativity of 1×10^{-4} . The data, type curve match and associated calculations are included in Attachment B-3.

Distance Drawdown Analysis of Packer Test Round 3, Test 3

The data from the Round 3, Test 3 packer test also lent itself to a distance drawdown analysis using the Cooper-Jacob method. In this packer test, Well C-7 in the upper permeable zone was pumped and drawdowns in Wells C-6, C-8, C-9 and C-10 were measured in the upper permeable zone. In this analysis Well C-6 and C-10 provide the most useful data since they are at significantly different radial

distances from the pumped interval. This test suggests some degree of areal anisotropy with a slightly higher transmissivity along the strike of the formation. Similar anisotropy is not observed in other data sets, however, and the apparent areal anisotropy observed in Round 3, Test 3 is probably coincidental. The distance drawdown analysis results in an average transmissivity of 13,000 gallons per day per foot and a geometric mean storativity of 6×10^{-6} . The data plots and calculations are included in Attachment B-4.

Neuman-Witherspoon Ratio Method Analysis of Packer Test Round 3, Test 3

In order to get some information as to the vertical hydraulic conductivity of the upper bedrock zone, ECKENFELDER INC. conducted Neuman-Witherspoon ratio method analyses of the Round 3, Test 3 packer test. The analysis specifically involved analysis of Wells C-8 and TW-3, and C-10 and TW-4. These analyses were done using recovery data for the reasons described earlier. The time recovery plots and calculations of both ratio method analyses are presented in the appendices. The analyses resulted in estimated vertical hydraulic conductivity values of 1.1×10^{-4} and 6.5×10^{-5} centimeters per second. These analyses would be representative of order of magnitude estimates. The data plots and calculations are presented in Attachment B-5.

SUMMARY OF QUANTITATIVE ANALYSES

In connection with the principal aquifer, the average transmissivity calculated from the three Theis type curve match analyses conducted by CDM and the five Theis type curve match analyses conducted by McLaren/Hart is approximately 12,700 gallons per day per foot. Similarly, the average storativity is approximately 2×10^{-4} . The average transmissivity of the upper permeable zone, calculated from the values obtained from the Theis type curve match of time recovery data from packer test, Round 3, Test 3 of Well C-6 and the distance drawdown analyses of packer test Round 3, Test 3 is 12,650 gallons per day per foot. The storativity is on the order of 1×10^{-4} as estimated from the time recovery analysis of Well C-6. The much lower value calculated from the distance drawdown analyses is probably

unrepresentative. Although some indication of areal anisotropy was observed in the drawdowns of Packer Test, Round 3, Test 3, generally, areal anisotropy is not indicated in the preponderance of the data. The spatial differences in drawdown are more likely attributable to typical fractured rock heterogeneity than to a systematic areal anisotropy.

10.0218

ATTACHMENT B
AQUIFER TEST PLOTS AND CALCULATIONS

10.0219

ATTACHMENT B-1

**DISTANCE DRAWDOWN ANALYSES OF
RI PACKER TEST DATA
WELL DMW-10 (ROUND 3, TEST 2)**

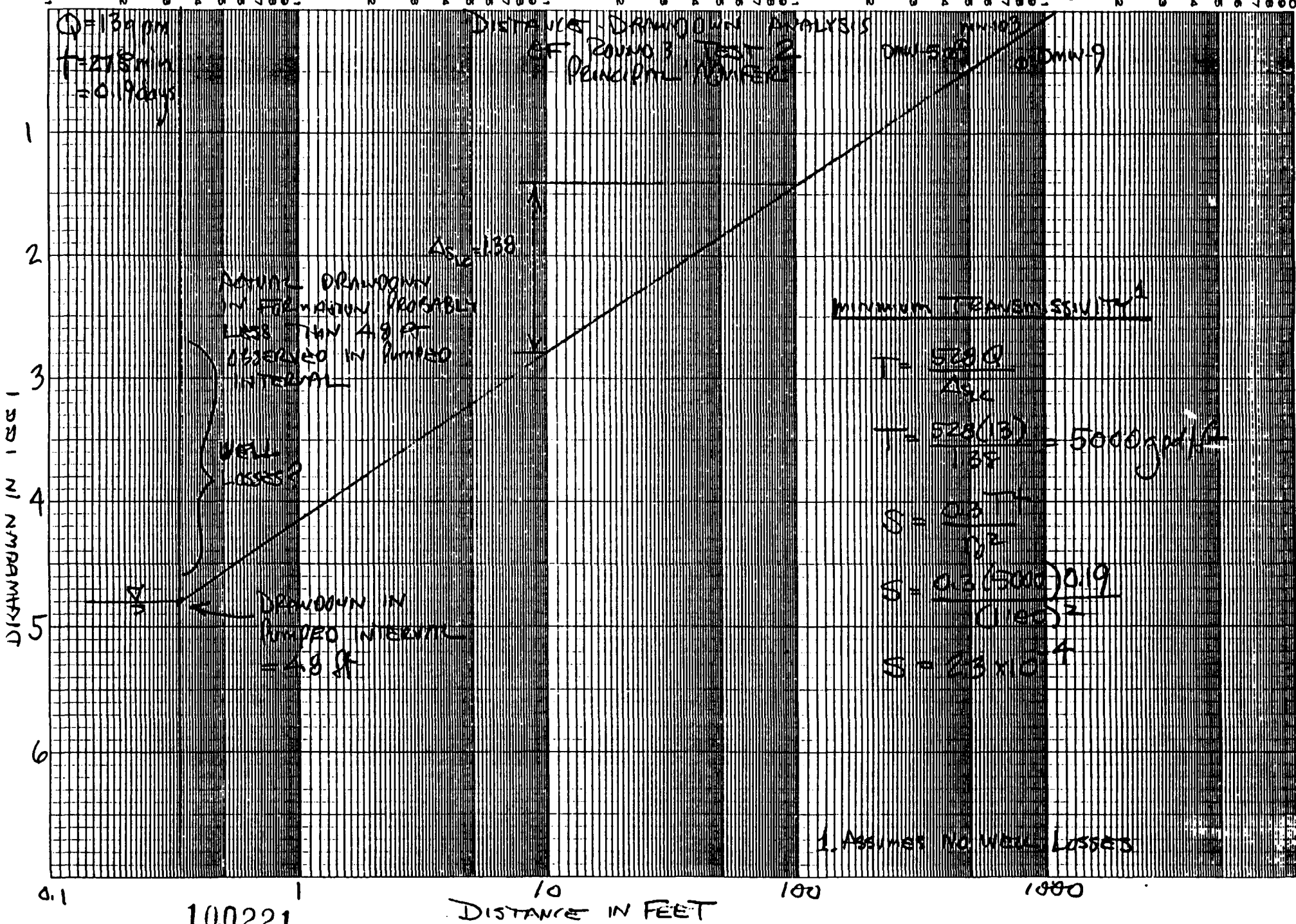
10.0220

$r_0 = 1180 \text{ ft}$

$Q = 139 \text{ gpm}$
 $t = 275 \text{ min}$
 $= 0.9 \text{ days}$

DISTANCE-DRAWDOWN ANALYSIS
OF ROUND 3 TEST 2
PRINCIPAL CONFERENCE

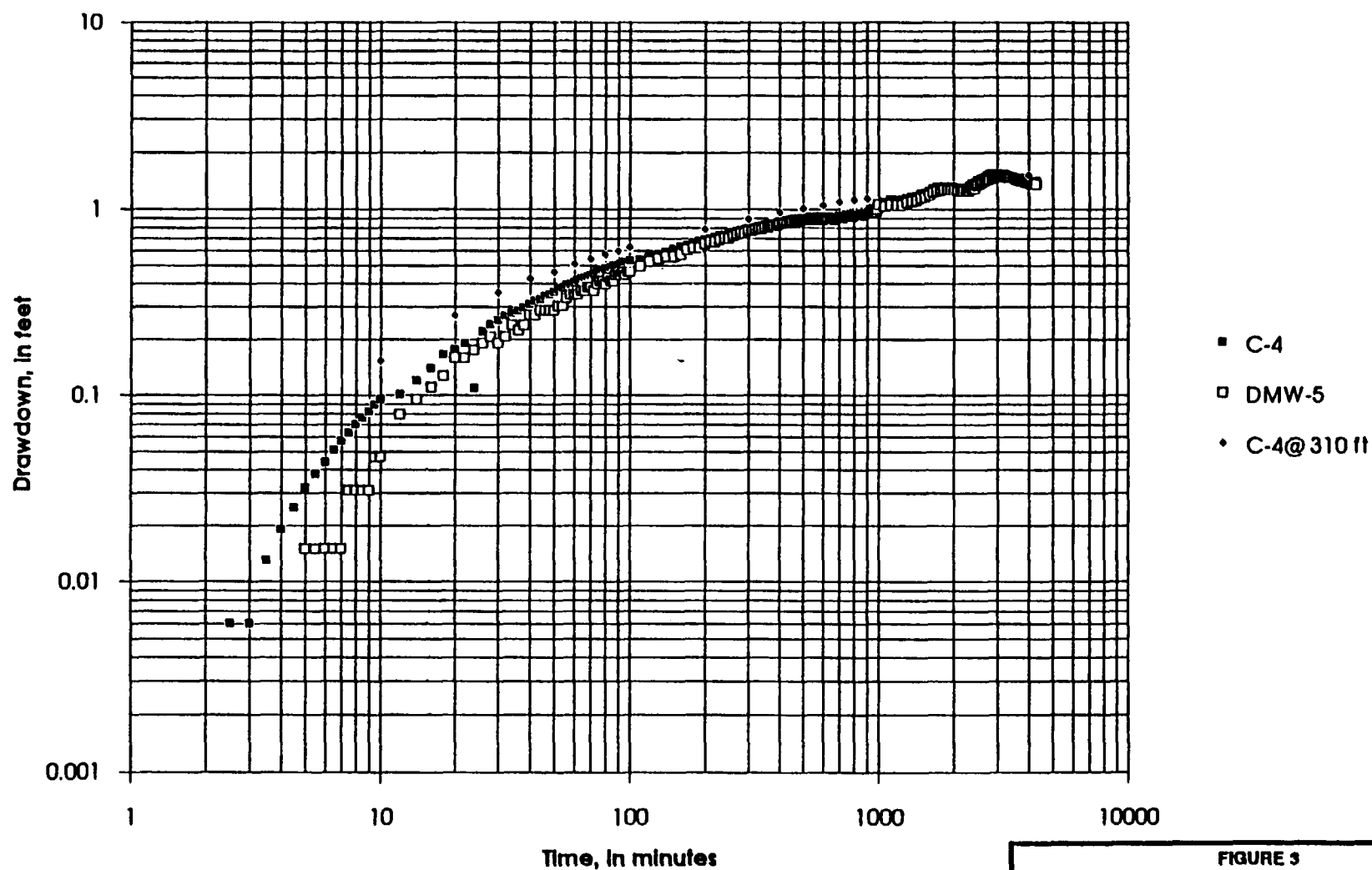
DNV-503
DNV-9



ATTACHMENT B-2

**NEUMAN-WITHERSPOON ANALYSES OF
McCLAREN-HART AQUIFER TEST DATA**

100222



Radial Distances: C-4, 360 ft; DMW-5, 310 ft

10 minutes
 $k = 3.5 \times 10^{-4} \text{ cm/sec}$

30 minutes
 $k = 3.5 \times 10^{-4} \text{ cm/sec}$

FIGURE 3

**Time Drawdown Curves
 October 1992 Aquifer Test**

Chemsol Site Trust
 Piscataway, New Jersey

**ECKENFELDER
 INC.®**

Nashville, Tennessee
 Mahwah, New Jersey
 Greenville, South Carolina

100223

NFW Analysis of C-4 and DMW-5z z 60 ftCalculation of K' at $t = 10$ min

$$t_D = \frac{9.28 \times 10^{-5} (10,880) 10}{(310)^2 1.9 \times 10^{-4}}$$

$$t_D = 0.54$$

$$\frac{s'}{s} = \frac{0.05}{0.15} = 0.33$$

$$t_D' = 1.9 \text{ (from graph)}$$

$$\alpha' = \frac{1.077 \times 10^{-4} (60)^2 1.9}{10}$$

$$\alpha' = 7.4 \times 10^6$$

$$K' = 7.4 \times 10^6 (1 \times 10^{-6}) = 7.4 \text{ gpt/ft}^2 \\ = 3.5 \times 10^{-4} \text{ cm/sec}$$

C-4 and Amw-5

$t = 30 \text{ mins}$

$$t_D = \frac{9.28 \times 10^{-5} (10,800) 30}{(310)^2 1.9 \times 10^{-4}}$$

$$t_D = 1.6$$

$$\frac{S'}{S} @ 30 \text{ min} = \frac{0.20}{0.35} = 0.57$$

$$t_D' = 5.7$$

$$\alpha' = \frac{1.077 \times 10^4 (60)^2 5.7}{30}$$

$$\alpha' = 7.4 \times 10^6$$

$$K' = 7.4 \times 10^{-6} (1 \times 10^{-6})$$

$$= 7.4 \text{ gpd/ft}^2$$

$$= 3.5 \times 10^{-4} \text{ cm/sec}$$

ATTACHMENT B-3

**THEIS TYPE-CURVE ANALYSES OF RECOVERY
DATA FROM RI PACKER TEST
WELL C-6 (ROUND 3, TEST 3)**

10.0226

16 7522

WELL C-6

(ROUND 3, TEST 3)

r = 800 FT.

Q = 56 gpm
r = 800 ft

Time-Recovery Analysis
of Round 3, Test 3
Well C-6
UPPER AQUIFER

MATCH POINT
 $\left\{ \begin{array}{l} w(u) = 1.0 \\ u = 100 \\ s = 0.52 \\ t = 1450 \text{ min} \end{array} \right.$

$$T = \frac{114.6 Q}{s} w(u)$$

$$T = \frac{114.6(56)}{0.52} \cdot 1.0$$

$$T = 12,300 \text{ gpd/ft}$$

$$S = \frac{uT}{2.43 r^2}$$

$$S = \frac{0.41(12300)(1450)}{2.43(800)^2}$$

$$S = 1 \times 10^{-4}$$

Time (min)

START pump 10:24 3/11
STOP pump 14:30 3/11

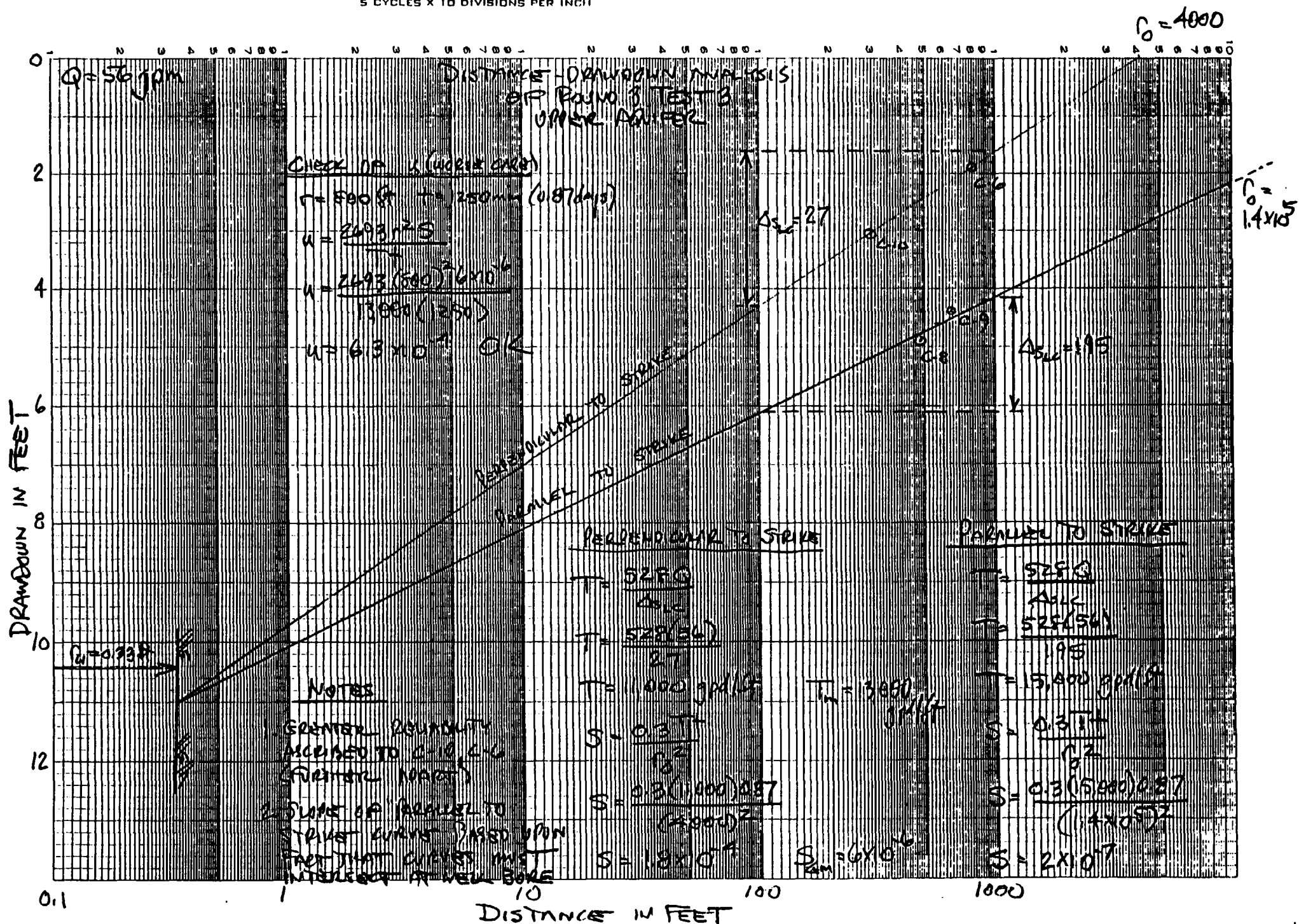
Q = 56 gpm

RECOVER (5 max) 1.111

10.0227

ATTACHMENT B-4

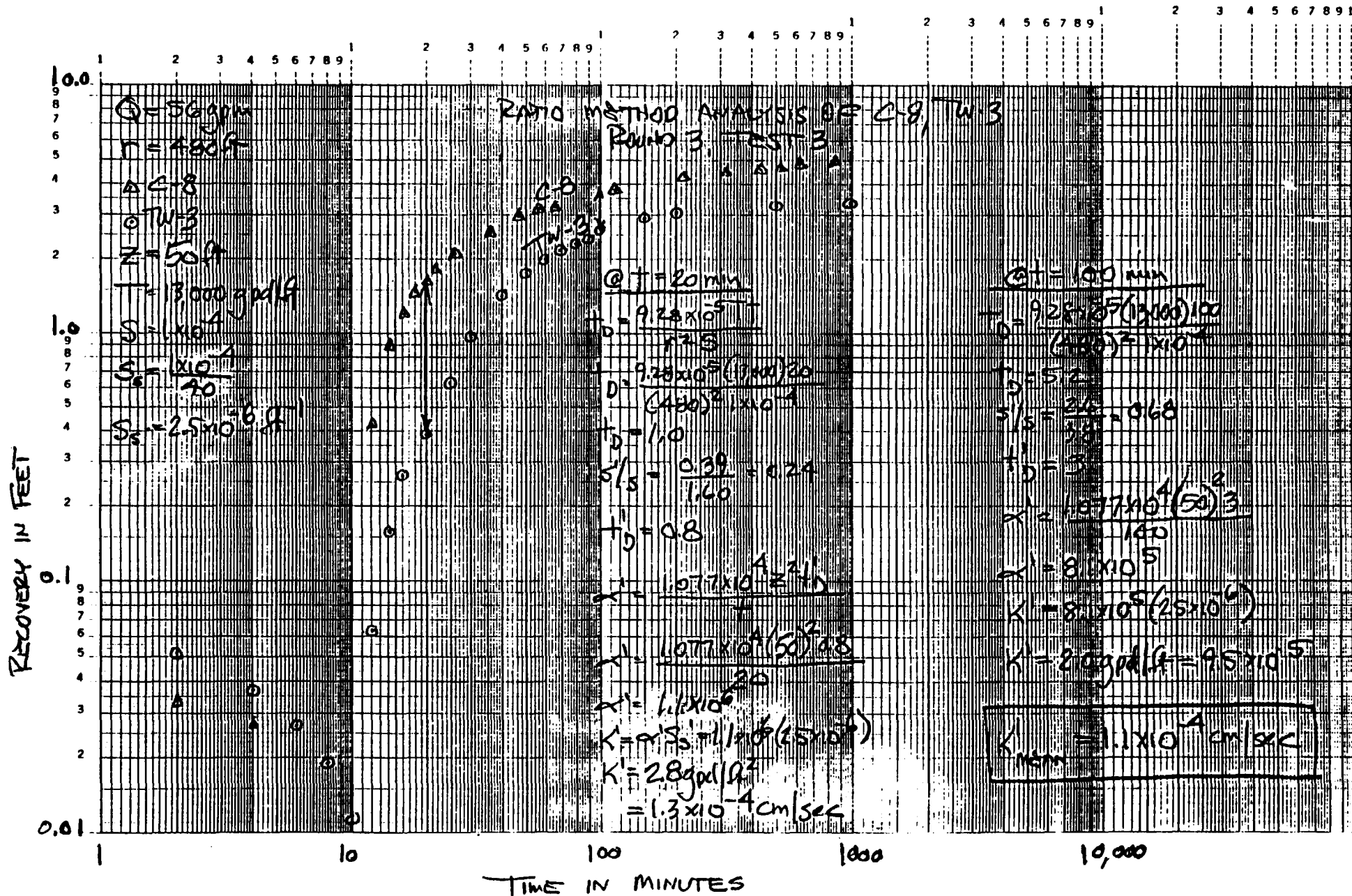
**DISTANCE-DRAWDOWN ANALYSES OF
RI PACKER TEST DATA
WELL C-7 (ROUND 3, TEST 3)**



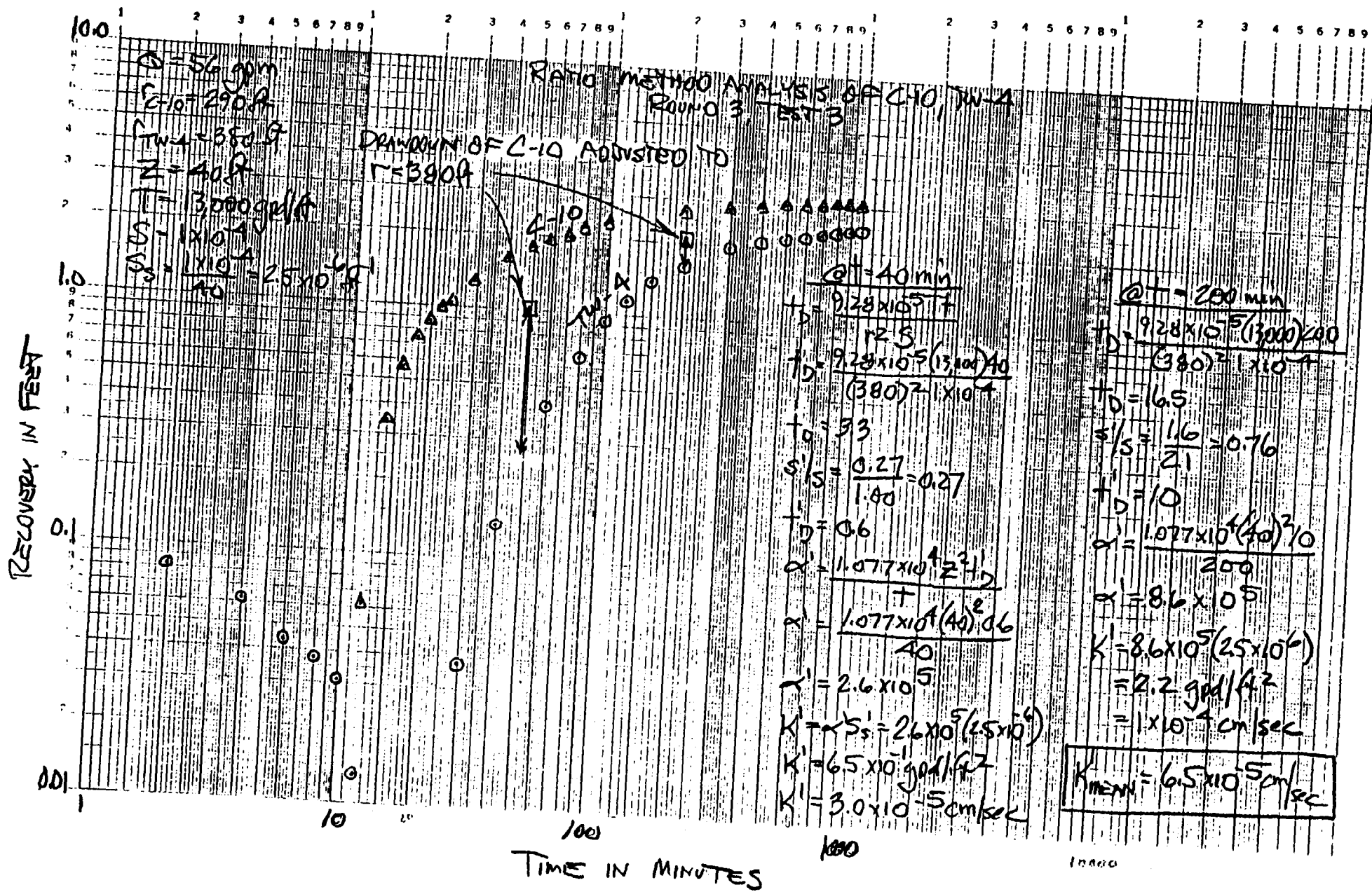
ATTACHMENT B-5

**NEUMAN-WITHERSPOON ANALYSES OF
RI PACKER TEST DATA
(ROUND 3, TEST 3)**

100230



10.0231



10.0232

ATTACHMENT C
WELL SURVEY

10.0233

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
1	2512153	1964	Hall, Eugene B	New Market	NA	100	15	33042	2047858	627082
2	261721	NA	Dichl, John K. Jr.	S. side of Carpathia St., 200 ft E of New Brunswick Ave.	NA	138	10	33473	2030480	635082
3	256775	1957	Campanella, Dominick	New Market, Middlesex County	NA	130	10	33685	2053991	637750
3	2510586	1962	Spadafora, Fred	New Market	Domestic	115	10	33685	2053991	637750
3	2516248	1972	Mason Candlelight Co.	820 Lincoln Blvd, Middlesex, N.J.	NA	210	40	33685	2053991	637750
3	2536222	1990	Polon, Art	341 High St., Dunellen, NJ	NA	51	8	33685	2053991	637750
4	2523596	1983	Swarm, John	Lot 18 Block:55 Municipality: Dunellen Boro	NA	75	15	33686	2055013	637750
5	2518766	1978	Dobusz, Gregory	Lot 53-54-55, Bl. 292, Piscataway, Middlesex	Na	150	12	33686	2053991	636416
5	2522656	1982	Design Molding Services, Inc.	Lot 1-15-32-47	NA	450	125	33688	2053991	636416
5	4500252	1969	Design and Molding Services, Inc.	25 Howard St. Piscataway	NA	390	120	33688	2053991	636416
6	2511182	1963	Max Schaefer & Sons	Grant Ave. off Country Club Rd., S. Madison Ave.	NA	125	25	33689	2055013	636416
6	2511288	1963	Beavers, Rose	Clay Ave., New Market NJ	NA	110	50	33689	2055013	636416
6	2521575	1980	Bybel, Robert	Lot 1. Bl. 161, Piscataway Twp., Middlesex Cty	Na	100	60	33689	2055013	636416
7	251125	1951	Viviano, John F.	Box 196 Blackford Avenue, New Market, NJ	NA	100	4	33685	2050924	633750
7	257340	NA	Russonarm, Jerry	New Market, NJ	NA	200	50	33685	2050924	633750
7	257910	1958	Lane, Russell	Mountain Ave, New Market	NA	109	35	33685	2050924	633750
8	259223	1960	Wood Sorg. Inc	Piscataway Twp.	NA	100	20	33688	2050924	632416
9	256823	1957	Mr. Wilson	NA	NA	104	10	33691	2052969	635082
9	259770	NA	Freile, Herbert	North side of 3rd St., 200 ft W of Blackford Ave.	NA	120	15	33691	2052969	635082
9	2520865	1979	Breslin, Elaine	Lot 25-28, Bk. 156 Piscataway, Middlesex, NJ	NA	130	25	33691	2052969	635082
10	2511765	1964	Haas, George	Leunellen, New Jersey	NA	125	20	33693	2055013	635082
11	258632	1959	Alberino, August	E Side of Davis St., 200 Ft S of Williams St.	NA	113	15	33694	2052969	633750
11	259771	NA	Klein, Anderson	W side of Plainfield Ave, 500ft N of First Ave.	NA	115	15	33694	2052969	633750
12	258904	NA	Osborn, Hollis	East side of No. Randolph Rd., 1500 ft South of New Market NJ	NA	130	10	33697	2052969	632416
12	2536281	1990	Warger, Robert	172 Middlesex Ave, Piscataway, NJ	NA	52	10	33697	2052969	632416
13	2519037	1978	Global Development	Piscataway-Somerset	NA	130	20	33922	2050924	631082
13	2520085	1978	Solvato, Leonard	Lot, 26, Block 350, Piscataway Middlesex	NA	90	10	33922	2050924	631082
13	2520411	1978	Zazzara, Tony	Lot 4, Block 365, Piscataway, Middlesex	NA	100	10	33922	2050924	631082
13	2525600	1984	Kiernan, James	Lot 5-D bl. 364	NA	200	10	33922	2050924	631082
14	2519038	1977	Global Development	Piscataway, Somerset Co.	NA	120	10	33923	2051946	631082
14	2526144	1985	Perm Const. Co. Inc.	Lot: 9194 Block: 452 Municipality: Piscataway Twp.	NA	125	10	33923	2051946	631082
15	2517258	1973	J. Middlesex Builders Inc.	Hillsborough Twp., Somerset, Campain Rd, Lot: 40 Bl: 141	NA	140	40	33926	2051946	629750
15	2517258	1973	J. Middlesex Builders Inc.	Hillsborough Twp., Somerset, Campain Rd, Lot: 40 Bl: 141	NA	140	40	33926	2051946	629750
16	2527118	1986	Pelmont Builders	Lot: 6.01 Block: 823	NA	225	40	33928	2050924	628416
17	251208	1951	Green, Earl	Piscataway Twp., Middlesex County	NA	115	16	33935	2053991	629750
18	222750	1958	Union Steel Corp.	Piscataway NJ	NA	300	120	33936	2055013	629750
19	2523677	1983	Captive Plastics	Lot: 11 Bl: 457B Municipality: Piscataway Twp.	NA	50	200	33937	2052969	628416
19	2515990	1971	Captive Plastics Inc.	Piscataway, Middlesex	NA	240	100	33937	2052969	628416
19	2519951	1978	Vocisano, Louie	Middlesex Ave.	NA	125	10	33937	2052969	628416
20	257478	1958	Koenig, Shirley A.	Possumtown Rd. Possumtown, NJ	NA	40	30	33939	2055013	628416
21	2525656	1985	Pelmont Builders	Lot: 8 Block: 376 Municipality: Piscataway Twp.	NA	150	30	33952	2050924	627082
21	2525657	1985	Pelmont Builders	Lot: 5 Block: 376 Municipality: Piscataway Twp	NA	175	30	33952	2050924	627082
22	257561	1958	Newton, Clinton	NA	NA	98	10	33953	2051946	627082
22	257562	1958	Newton, Clinton	NA	NA	93	10	33953	2051946	627082
22	2516900	1973	Marx, Peter	Lot: 8 Blk: 352 Blackford Rd., Piscataway Twp., Somerset	NA	145	40	33953	2051946	627082
22	2527774	1986	Pelmont Builders	Lot: 6B Block: 823 Municipality: Piscataway Twp.	NA	200	0.71	33953	2051946	627082

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
23	2527976	1986	Koba Corporation	Lot:4 Block:361 Municipality: Middlesex Boro	NA	300	80	33956	2051946	625750
23	2527975	1986	Koba Corporation	Lot:4 Block:361 Municipality: Middlesex Boro	NA	300	150	33956	2051946	625750
23	25321978	1988	Beecham Labs	101 Possumtown Rd. Piscataway, NJ 08854	NA	48	25	33956	2051946	625750
23	2532198	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ 08854	NA	12	NA	33956	2051946	625750
23	25321994	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	13	NA	33956	2051946	625750
23	25322001	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	48	5	33956	2051946	625750
23	25322010	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	15	NA	33956	2051946	625750
23	25322028	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	48	12	33956	2051946	625750
23	25322036	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	20	NA	33956	2051946	625750
23	25322044	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	58	20	33956	2051946	625750
23	25322052	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	53	2	33956	2051946	625750
23	25322061	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	41	0.75	33956	2051946	625750
23	25322079	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	15	<1	33956	2051946	625750
23	25322087	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	51	<2	33956	2051946	625750
23	25322095	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	50	10+	33956	2051946	625750
23	25322109	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	11.5	NA	33956	2051946	625750
24	258389	1959	Puzio, Walter	Bridgewater Twp.	NA	170	10	33959	2051946	624416
25	257557	1958	Piluso, Steve	NA	NA	97	10	33961	2052969	627082
25	257560	1958	Winkleholz, Charles	NA	NA	107	10	33961	2052969	627082
25	2510303	1961	Jay R. Smith MFG. Co.	NA	NA	166	60	33961	2052969	627082
25	2527466	1986	Rosamelia, Tony	Lot: 1-6 Block:363 Municipality: Piscataway, NJ	NA	150	10	33961	2052969	627082
25	25300741	1987	L Tech Welding	239 Old New Brunswick Rd., Piscataway, NJ	NA	24	NA	33961	2052969	627082
25	25300750	1987	L. Tech Welding	239 Old Brunswick Rd., Piscataway, NJ	NA	45	NA	33961	2052969	627082
25	256463	1957	Gubernat, John	Stelton, Middlesex Co.	NA	130	10	33961	2052969	627082
26	251145	1951	Kulak, Joseph	Old New Brunswick Rd., Piscataway, NJ	NA	112	13	33962	2053991	627082
26	2534669	1989	Bedell, Dan	480 Sidney Rd., Piscataway, NJ	NA	250	20	33962	2053991	627082
27	25176	1948	Pastluck, Patrick	Piscataway, Twp., Middlesex Co.	NA	89	20	33964	2052969	625750
27	2532241	1988	Beecham Labs	101 Possumtown Rd., Piscataway, NJ	NA	10	NA	33964	2052969	625750
27	2532242	1988	Beecham Labs	101 Possumtown Rd. Piscataway, NJ	NA	10	NA	33964	2052969	625750
27	2533622	1989	L-Tec	239 Old New Brunswick Rd., Piscataway, NJ	NA	50	NA	33964	2052969	625750
27	253623	1989	L-Tec	239 Old New Brunswick Rd., Piscataway, NJ	NA	10	NA	33964	2052969	625750
28	2530319	1987	Inst. of Electrical Electronics	Hoes Lane Piscataway, NJ	NA	20	NA	33967	2052969	624416
28	2530320	1987	Inst. of Electrical Electronics	Hoes Lane, Piscataway, NJ	NA	21	NA	33967	2052969	324416
29	251281	1951	Hoegberg, Otto	Piscataway Twp, Middlesex Co.	NA	87	16	33991	2052969	623082
29	2532371	1988	Pelmont Builders	31 Stelton Rd. Suite 5, Piscataway, NJ	NA	200	10	33991	2052969	623082
30	2520861	1979	Tina Construction Co.	27 Franklin St. Piscataway N.J.	NA	185	20	33992	2053991	623082
30	25375	1948	Kistler, Esther	RD#2, New Brunswick, NJ	Domestic	198.5	16	33995	2053991	621750
31	NA	1968	National Starch & Chemical Corp.	1735 W. Front Street, Plainfield, NJ	Industrial	600	NA	34418	2057058	640416
31	25677	1950	Asphalt & Mineral Corp.	NA	Industrial	200	250	34418	2057058	640416
31	2520864	1979	William & Vee Hamilton	171 Mountain Ave. Piscataway, NJ	Domestic	100	10	34418	2057058	640416
32	25762	1950	Art Color Printing CO.	South & Washington Ave.	Industrial	325	226	34419	2058080	640416
32	2512498	1964	DeMatteo, Poi	Sunlit Dr. Watchung, NJ	Domestic	92	6	34419	2058080	640416
33	257609	1958	Gray, Douglas	252 Pearl Place, Dunellen, NJ	Domestic	102	10	34427	2059102	640416
34	2534508	1958	DeMatteo, Pio	586 Warfield Ave, North Plainfield, NJ	Domestic	115	10	34428	2060124	640416
34	25213248	1971	Elizabethtown Water Co.	1341 North Ave, Plainfield, NJ	Public Sup	350	400	34428	2060124	640416
34	2518634	1976	Nesler, J.	NA	Domestic	125	10	34428	2060124	640416

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
35	2510160	1961	Hocke, Mary	Piscataway Twp., NJ	Domestic	95	10	34429	2061146	640416
36	251194	1951	Simmons, Raymond	Piscataway Twp. NJ	Domestic	100	6.25	34430	2064213	640416
37	256925	1957	De Censo, Emilio	NA	Domestic	110	10	34437	2062169	640416
37	257530	1958	Pillsbury, Samul	Smith Street, Middelhush, NJ	NA	125	24	34437	2062169	640416
37	258431	NA	Norman, Richard	North Side of Quincy Street; 400 East of Rock Avenue	Domestic	115	15	34437	2062169	640416
37	258621	NA	Panzarello, P.	South side of West 7th Street, approx. 100 feet east of New Brunswick Ave.	Domestic	143	15	34437	2062169	640416
37	258759	1959	Barra, Louis	NA	Domestic	107	12	34437	2062169	640416
38	258202	1959	DiDario, Armond	North of S. 10th St. & east of New Brunswick Ave.	Domestic	90	11	34438	2063191	640416
38	2521914	1981	Wedgie, Philip	Lot 24, Block 33, Dunellen, Piscataway Township, NJ	Domestic	175	100	34438	2063191	640416
39	259060	1959	Olechna, Clem	South Plainfield, NJ	Domestic	110	0.2	34439	2064213	640416
39	2431426	1988	Macedo Concrete Corp.	Parker Rd., South Plainfield, NJ	Industrial	160	0.3	34439	2064213	640416
40	251121	1951	Smith, M.	Lehigh St. Dunellen, NJ	Domestic	100	NA	34442	2057058	639082
40	259145	1960	Vescovi, T.	1715 Meister St. Arbor, NJ	Domestic	130	15	34442	2057058	639082
41	2510225	1962	DeMattoo, Pio	Piscataway Twp. NJ	Domestic	100	7	34443	2058080	639082
42	258109	1958	Venturo, Emil	NA	Domestic	95	10	34445	2057058	637750
42	258311	1959	NA	New Market Rd.	Domestic	120	15	34445	2057058	637750
43	2532529	1989	Turner & Pacconi Constuction	Hall Street Piscataway, NJ	Domestic	150	0.3	34446	2058080	637750
44	2510256	1961	Hanzl, A.	42 Maple Street, Oaktree Edison, NJ	Domestic	125	10	34447	2058036	636416
45	254289	1963	Milets, Racco	New Market 11st. off Washington Ave.	Domestic	120	10	34449	2058080	636416
46	256984	1957	Beyerman, Vince	NA	Domestic	74	10	34452	2060124	639082
46	258037	1958	Shumsky, Peter	NA	Domestic	93	10	34452	2060124	639082
46	256984	1957	Beyerman, Vince	NA	Domestic	74	10	34452	2060124	639082
46	258037	1958	Shumsky, Peter	NA	Domestic	93	10	34452	2060124	639082
47	25653	1957	Beyerman	NA	Domestic	90	10	34453	2061146	639082
47	256716	1957	Papa, Barbara	NA	Domestic	104	10	34453	2061146	639082
47	256996	1957	Hahr, Arthur	South side of Brunelle St., west of New Brunswick Ave.	Domestic	120	10	34453	2061146	639082
47	257170	1957	Pikuso, Steve	NA	Domestic	90	10	34453	2061146	639082
47	257342	1957	K.L.M. Buliders	NA	Domestic	99	10	34453	2061146	639082
47	27499	1958	Calloway, Cleveland	NA	Domestic	107	10	34453	2061146	639082
47	258623	NA	Muglia, Albert	North side of Quincy Street; 250 feet East of West 7th street	Domestic	100	15	34453	2061146	639082
47	258885	1959	Newton, Clinton	NA	Domestic	94	10	34453	2061146	639082
48	2511102	1963	Channin, Brown	Marion La. Plainfield Road, NJ	Domestic	128	8	34455	2060124	637750
49	256919	1957	Toshy, John	710 Delmore Ave, South Plainfield Ave, NJ	NA	95	10	34547	2065236	636416
49	257117	1957	Guaranteed Block Co.	East side of Clinton Ave., 200ft N. of New Market Ave.	NA	125	15	34547	2065236	636416
49	2535868	1990	Bratone, Arthur	2364 S. Clinton Ave, South Clinton NJ	NA	12	NA	34547	2065236	636416
50	2532832	1989	Cillis, Joseph Jr.	1521 Sage St., South Plainfield, NJ	NA	61	1	34548	2066258	636416
51	254426	1963	Dodd, May	Planfield Ave & @2nd st.	Domestic	125	8	34550	2070346	636416
52	2540944	1992	Penske Truck Leasing	2364 South Clinton Ave. South Plainfield, NJ	NA	18	NA	34554	2068302	637750
52	25190	1949	Middlesex Water Co.	Borough of South Plainfield, NJ	NA	403	412	34554	2068302	637750
52	25421	1949	Middlesex Water Co.	South Plainfield, N.J.	NA	409	542	34554	2068302	637750
53	28490	1986	Recifro, Frank	222 Barone Ave. South Plainfield, NJ	NA	125	NA	34555	2069324	637750
53	252090	1952	Middlesex Water Co.	South Plainfield N.J.	NA	502	465	34555	2069324	637750
53	252091	1952	Middlesexwater Co.	South Plainfield, NJ	NA	525	440	34555	2069324	637750
53	253969	1954	Middlesex Water Co.	Boro of South Plainfield	NA	526	NA	34555	2069324	637750
53	2522255	1981	Atlantic Richfield Co.	rear of Asphalt lot, 31ft North of Station Blvd.	NA	10	NA	34555	2069324	637750
53	2522256	1981	Atlantic Richfield Co.	38' N of gas pump nearest Lakeview Ave.	NA	10	<1	34555	2069324	637750

LOW CAPACITY WELLS
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Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
53	2522257	1981	Atlantic Richfield Co.	Southeast corner of station property, 10' W of sidewalk	NA	10	<1	34555	2069324	637750
53	252258	1981	Atlantic Richfield Co.	17' W of Guard on Lakeview Ave., between creek & asphalt	NA	20	<1	34555	2069324	637750
54	2512829	1985	Keystone Plastics Inc.	S. Clinton Ave., S. Plainfield	NA	300	200	34557	2068302	636416
54	2521571	1980	Mastrianni, Patric	Lot 3, Block 348, S. Plainfield, Middlesex Co.	NA	50	30+	34557	2068302	636416
54	2525751	1984	Campagna, Philip	Lot 9-10, Block 427, Municipality: South Plainfield Boro	NA	150	25	34557	2068302	636416
55	2529539	1987	Barietta, Alex	700 delmore Ave., Middlesex S. Plainfield, NJ	NA	140	25	34559	2070346	636416
56	2541529	1992	Pulsafeeder Co.	2387 south Clinton Ave.	NA	71.4	12	34571	2065236	635082
56	41530	1992	Pulsafeeder Co.	2387 south Clinton Ave.	Na	76.7	14	34571	2065236	635082
56	2541531	1992	Pulsafeeder Co.	2387 South Clinton St.	NA	74.8	15	34571	2065236	635082
56	2541532	1992	Pulsafeeder Co.	2387 South Clinton St.	NA	75	12	34571	2065236	635082
56	258617	NA	Colvin, Frank H.	S. side of Sage St.; 250ft W of South Clinton Ave.	Na	113	Na	34571	2065236	635082
57	2521332	1980	Pellegrino, John	Lot: 15-20, Block: 498, So. Pld. Middlesex	NA	125	25	34572	2068258	635082
58	259075	1959	Turi, Charles A.	South Plainfield NJ	NA	100	20	34574	2065236	633750
59	2524382	1983	Kays, Jane	Lot: 5-8, Block: 292	NA	170	<14	34575	2066258	633750
59	2530161	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, N.J.	NA	10	NA	34575	2066258	633750
59	2530162	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, N.J.	NA	10	NA	34575	2066258	633750
59	2534575	1987	Silverman, Ken	105 Sylvania Av. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2530164	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2530165	1987	Silverman, Ken	105 Sylvania Ave., South Plainfield, NJ	NA	10	NA	34575	2066258	633750
60	25316991	1988	Atlantic tool & die Co.	Lot: 2.03	NA	38	NA	34576	2067280	633750
60	2531700	1988	Atlantic Tool & Die	Lot: 2.03, Block: 447	NA	38	NA	34576	2067280	633750
60	2530565	1987	Atlantic Tool & Die	Lot: 2.03	NA	12	NA	34576	2067280	633750
60	25316982	1988	Atlantic Tool & Die	Lot: 2.03	NA	40	NA	34576	2067280	633750
60	2524448	1983	Celeniano, Julius	Lot: 74-7, Block: 315 Municipality: South Plainfield Boro	NA	150	30+	34576	2067280	633750
60	2513094	1965	Ladis, William	South Plainfield, N.J.	NA	100	40	34576	2067280	633750
60	2522615	1982	Gian, Di D. & son	Lot: 73 Block: 315	NA	150	25	34576	2067280	633750
60	259517	1960	Turi, Charles A.	South Plainfield	NA	100	15	34576	2067280	633750
61	259646	NA	Yulick, Robert	NA	NA	130	15	34582	2069324	635082
61	2520170	1978	Global Development Company	Lot: 11-12, Block: 316, S. Old Middlesex Co	NA	110	30	34582	2069324	635082
61	25344056	1989	Witmer, Ivan	375 Metuchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
61	25344064	1989	Witmer, Ivan	375 Metuchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
61	255344072	1989	Witmer, Ivan	375 Metuchen Rd., S. Plainfield Rd.	NA	13	NA	34582	2069324	635082
61	25344072	1989	Witmer, Ivan	374 Metuchen Rd., S. Plainfield, N.J.	NA	13	NA	34582	2069324	635082
62	25844	1951	Kentile, Inc.	South Plainfield, N.J.	NA	461	310	34583	2070346	635082
62	2522109	1981	Wood Construction Co.	Lot: 49-53, Block: 457,	NA	51	15	34583	2070346	635082
62	2523878	1983	Raritan Oil Co.	NA	NA	8	NA	34583	2070346	635082
62	2523879	1983	Raritan Oil Co.	NA	NA	24	NA	34583	2070346	635082
62	2523880	1983	Raritan Oil Co.	NA	NA	19	NA	34583	2070346	635082
62	2523880	1983	Raritan Oil Co.	NA	NA	19	NA	34583	2070346	635082
62	2534528	1989	Sub Transit	601 Market Ave., South Plainfield, N.J.	Na	12	Na	34583	2070346	635082
62	2534529	1989	Suburban Transit	601 Market Ave., South Plainfield, NJ	NA	13	NA	34583	2070346	635082
62	2534530	1989	Suburban Transit	601 Market Ave., South Plainfield, NJ	NA	13	NA	34583	2070346	635082
63	258228	1959	Piscatelli, Michael	N. of New York Ave., & W. of Hamilton Blvd., South Plainfield, N.J.	NA	113	35	34584	2068302	633750
63	258978	NA	Zereconski, Mildred	N. side of New York Ave., 300ft W. of West Hamilton Blvd.	NA	200	12	34584	2068302	633750
63	2519393	1977	Global Development Co.	Lot: 13, Block: 426, Camden Ave., South Plainfield	NA	120	15	34584	2068302	633750
63	2519392	1977	Global Development Co.	Lot: 14 Block: 426 New York Ave., South Plainfield	NA	110	30	34584	2068302	633750

100237

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Eastings (ft.)	Northings (ft.)
63	259045	NA	Shinkle, Anna	N. side of New York Ave., 400R W. of Hamilton Blvd.	NA	13	15	34584	2088302	633750
64	258203	1959	Butrico, Charles F.	E. of Garbaldi Ave., & S. of Tremont Ave.	NA	140	18	34585	2069324	633750
65	2527382	1986	Wood, Sal	Lot:7 Block:350 Municipality: South Plainfield Boro	NA	170	15	34586	2070346	633750
66	2525605	1985	Knight, Frank	Lot:10 Block:428	NA	130	12	34586	2070346	633750
67	2534040	1989	Kentile floors, Inc.	Lot:10 Block:255 S. Plainfield, N.J.	NA	8	NA	34591	2071369	635082
67	25745	1951	Kentile Inc.	South Plainfield, N.J.	NA	240	200	34591	2071369	635082
67	25725	1950	Cornell Dubilier Elec Corp.	South Plainfield, N.J.	NA	323.6	220	34591	2071369	635082
67	2514113	1966	Kentile, Inc.	Kentile Rd., S. Plainfield, NJ	NA	250	250	34591	2071369	635082
68	2528345	1986	Di Gian & Son Const Co.	South Plainfield, N.J.	NA	50	28	34594	2071369	633750
68	2522763	1982	Chevron Chemical Co.	South Plainfield N.J.	NA	10	10	34594	2071369	633750
69	2534157	1986	Zwolak, Frank	Lot:14 Block:354	NA	160	25	34597	2071369	632416
69	2510690	1962	Gordon, Earl C.	1003 Delmore Ave., S Plainfield N.J.	NA	50	30	34597	2071369	632416
69	2510227	1961	serido, Tony	Murih St., Dunellen, N.J.	NA	150	15	34597	2071369	632416
69	258692	NA	Ronzo, Elizabeth	S side of Delmore Ave., 250 ft E. of Lorraine Ave.	NA	113	15	34597	2071369	632416
70	2534699	1989	Chomut, Dimitri & Maria	8 Davidson Ave. Piscataway, Twp	NA	150	0.17	34699	2082613	632416
71	2511433	1963	Nesler, Joseph	Plainfield, NJ	NA	125	10	34711	2056036	631082
72	259453	1960	Owens, John Evan	New Market, Piscataway Twsp.	NA	110	15	34713	2058080	631082
72	25550	1949	Westergard, C. J.	Old Brunswick Rd., New Market, Middlesex Co.	NA	168	20	34713	2058080	631082
72	25453	1949	Roeth, Edward	New Market, Middlesex Co.	NA	153	45	34713	2058080	631082
74	25320611	1988	National Can Corporation	Lot:2 Block:461	NA	15	NA	34714	2058036	629750
74	25320602	1988	National Can Corporation	Lot:2 Block:461	NA	19	NA	34714	2058036	629750
75	258702	1959	Soden, John Edward	Edison Township, N.J.	NA	93	20	34715	2057058	629750
76	2543318	1994	Equity Associates	Stelton Rd., Piscataway Twp.	NA	300	35	34716	2058080	629750
77	2526281	1985	Rutgers State University	Electrical Engineering	NA	30	NA	34717	2056036	628416
77	2526280	1985	Rutgers State University	Electrical Engineering	NA	30	NA	34717	2056036	628416
77	2521986	1981	Boroughs Corp. CSG Division	S. Randolphville Rd. Lot:4A Block:460C	NA	300	200	34717	2056036	628416
78	2532941	1989	Wilson, William B.	120' S. of Montrose Ave., 160' W. of Kennedy Rd.	NA	11	NA	34718	2057058	628416
78	2529074	1987	Nat'l Can Corporation	Lot:2 Block:461	NA	15	NA	34718	2057058	628416
78	2529073	1987	Nat'l Can Corporation	Lot:2 Block:461	NA	15	NA	34718	2057058	628416
78	2529072	1987	Nat'l Can Corporation	Lot: 2 Block:461	NA	15	NA	34718	2057058	628416
79	25331230	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	NA	34719	2058080	628416
79	25331223	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25331213	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330845	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330837	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	NA	34719	2058080	628416
79	25330829	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330811	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330802	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330799	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
80	2512155	1964	Connelongo, Joseph	New Market, Piscataway, NJ	NA	135	15	34721	2059102	631082
81	2511468	1963	Colosi, Philip	300 Stelton Rd., New Market	NA	200	30	34721	2059102	631082
82	4500312	1950	National Starch	1735 West front st.	NA	300	350	34722	2060124	631082
82	25324888	NA	Texaco	Apgar Dr., South Plainfield, NJ	NA	300	350	34722	2060124	631082
82	35324870	NA	Texaco	Apgar Dr. South Plainfield, NJ	NA	10	NA	34722	2060124	631082
82	2522755	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	125	10	34722	2060124	631082
82	2522756	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	150	15	34722	2060124	631082

100238

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJOEP Locator	Easting (ft.)	Northing (ft.)
82	2522757	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	150	15	34722	2060124	631082
82	25324845	NA	Texaco	Appar Dr., Plainfield, NJ	NA	10	NA	34722	2060124	631082
82	258633	NA	Alberino, August	E side of Maple Ave., 200ft N of Winans St.	NA	115	15	34722	2060124	631082
82	25324853	NA	Texaco	Appar Rd., South Plainfield	NA	10	NA	34722	2060124	631082
83	4500313	1950	National Starch	1735 West Front St.	NA	304	350	34723	2061146	631082
83	2519144	1977	Huben, Robert	Lot:494, Block:10C, Piscataway	NA	195	40	34723	2061146	631082
84	258351	1959	Cavallo, Joseph	NE corner of Eva St. & Cumberland Ave.	NA	113	15	34725	2060124	629750
84	259683	NA	Manzell, Vincent	S. side of Cumberland St; 250 ft W of Washington Ave.	NA	130	12	34725	2060124	629750
85	2526562	1985	Anastasatos, Demetrios	Lot:32B, Block:484	NA	210	5	34726	2061146	629750
85	25317296	1988	United Jersey Bank	1450 S. Washington Ave., Piscataway, NJ	NA	17	NA	34726	2061146	629750
86	2523891	1983	Fischer, Chris	Lot:388 Block:5; Municipality: S. Plainfield	NA	285	90	34731	2062169	631082
86	2526404	1985	Jersey Concrete	Lot:388 Block:5 South Plainfield Boro	NA	340	60	34731	2062169	631082
87	258903	1959	Crawford, Earl	W. side of New Brunswick Ave.; 1000ft N of R.R. tracks	NA	145	12	34732	2063191	631082
87	259064	1960	Robertson, Clarence	NA	NA	152	7	34732	2063191	631082
88	2533537	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway NJ 08854	NA	15	NA	34734	2062169	629750
88	2511101	1963	Chemsol, Inc.	Stelton Rd, Piscataway N.J.	NA	305	190	34734	2062169	629750
88	2533533	1989	United Jersey Commercial Trust	Stelton Rd, Piscataway, NJ	NA	10	NA	34734	2062169	629750
88	2533534	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway, N.J.	NA	12	NA	34734	2062169	629750
88	2533535	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway, NJ	NA	10	NA	34734	2062169	629750
88	2533536	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway	NA	10	NA	34734	2062169	629750
89	258616	NA	Formal Builders	S side of Carpathia St; 170 ft W of Franko St.	NA	200	15	34735	2063191	629750
90	257605	1958	Saunders, Bruce J.	Randolph Rd., Piscataway, NJ	NA	100	10	34736	2064213	629750
90	25309838	1988	768 Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	81	2+	34736	2064213	629750
90	25309846	1988	Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	75	2+	34736	2064213	629750
90	25309854	1988	Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	76	2+	34736	2064213	629750
91	2530824	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	250	3	34737	2062169	628416
91	2530825	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	325	8	34737	2062169	628416
91	2530823	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	325	40	34737	2062169	628416
91	2520883	1979	Marra, A.	Lot:31-A2 Block:484, Piscataway, N.J.	NA	190	40	34737	2062169	628416
91	2530822	1988	Tano Realty	NA	NA	250	6	34737	2062169	628416
92	25316559	1988	768 Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	60	NA	34738	2063191	628416
92	25313367	1988	Tano Realty	Fleminono St., Piscataway, NJ	NA	80	1	34738	2063191	628416
92	25313223	1988	Tano Realty	Flemino St., NJ	NA	250	30	34738	2063191	628416
92	25313215	1988	Tano Realty	Flemino St., Piscataway, NJ	NA	340	7	34738	2063191	628416
92	25313207	1988	Tano Realty	Flemino St., Piscataway, NJ	NA	250	7	34738	2063191	628416
92	258615	NA	Formal Builders	N. side of St. Michael St., 175ft W of Franko St.	NAa	143	15	34738	2063191	628416
92	259156	1960	Parkway Plastics	New Market	NA	340	150	34738	2063191	628416
92	2510635	1962	All American Homes, Inc.	Piscataway Twp., Middlesex Co.	NA	122	8	34738	2063191	628416
92	2529291	1987	ARCO	Lot:9-12, Block:487; 780 Stelton St.	NA	19	1	34738	2063191	628416
92	2529292	1987	ARCO	Lot:9-12, Block:487; 780 Stelton St.	NA	18	1	34738	2063191	628416
92	25313193	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	330	NA	34738	2063191	628416
93	2510572	1962	Brown, Raymond C.	583 S. Randolph Rd. New Market, NJ	NA	125	8	34742	2057058	627082
93	2525320	1964	Doryea, Jeannette R.	Lot:3 Block:500A Municipality:Piscataway Twp	NA	125	25+	34742	2057058	627082
94	2520884	1979	Marra, Anthony	Lot:31-A1 Block:484, Piscataway NJ	NA	190	12	34756	2061146	625750
95	2510098	NA	Schreiber, Gilbert	S. side of Stelton Rd. 1000ft W. of Hamilton Blvd.	NA	130	10	34762	2063191	627082
96	2527597	1986	Sterling Extruder Corporation	Lot:4 Block: 550 Municipality: South Plainfield	Na	15	0	34764	2062169	625750

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

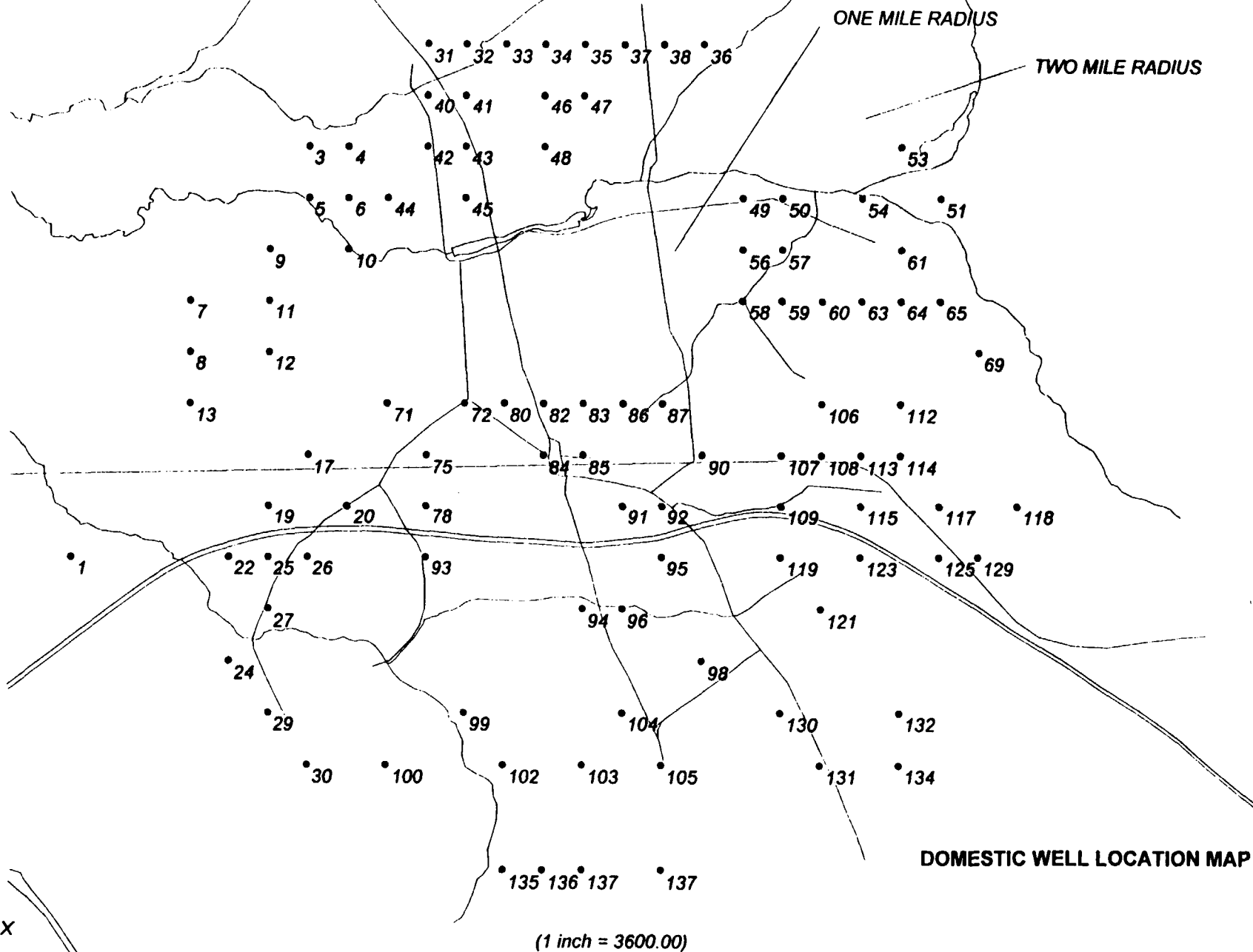
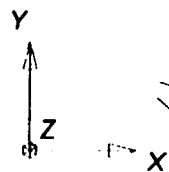
Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
96	252596	1986	sterling Extruder Corporation	Lot:4 Block:550 Minicipality: South Plainfield	NA	15	0	34764	2062169	625750
96	252144	1979	Dematto & Amato	Lot:27-33, Block:59, Muriel Ave, Piscataway NJ	NA	100	50	34764	2062169	625750
96	259089	1960	Westman, James	74 26' 37", 40 33' 4"	NA	122	12	34764	2062169	625750
96	2527598	1986	Sterling Extruder Corporation	Lot:4 Block:550 Municipality: South Plainfield	NA	15	1	34764	2062169	625750
97	25284517	1986	sterling Extruder corporation	Lot:4 Block:550 Durham Ave., South Plainfield, NJ	NA	94	1	34767	2062169	624416
97	2528450	1986	sterling Extruder Corporation	Lot:4 Block:550, Durham Ave., S. Plainfield	NA	94	4	34767	2062169	624416
98	259896	1961	Olechna, Clem	Piscataway Twp.	NA	130	20	34769	2064213	624416
99	261406	1956	Schenck, Richard	New Market	NA	130	12	34773	2058080	623082
99	261406	1956	Schenck, Richard	New Market, NJ	NA	130	10	34773	2058080	623082
100	2516338	1972	Skladany, Edward T.	Piscataway, NJ	NA	170	15	34774	2056036	621750
101	256793	1957	Lake Nelson Memorial	Lake Nelson	NA	95	24	34775	2057058	621750
102	2534029	1989	Marinelli, Joseph P.	604 S. Randolphville Rd.	NA	250	15	34784	2059102	621750
103	2521533	1980	J. DiLeo Associates	120 Sylvan Ave., Block:496, Lot:12 Piscataway Twp., Somerset Co.	NA	200	20	34786	2061146	621750
104	2519501	1977	Gerictoni, Theodore	Lot:9B Block:844C Middlesex Co.	NA	300	40	34791	2062169	623082
104	2511063	1962	Winkler, John	30 Lakeway St. New Market Ave.	NA	102	15	34791	2062169	623082
104	256886	1957	Szutelej, Henry	N. side of Woodlawn Rd., Lake Nelson Development, Piscataway, N.J.	NA	110	15	34791	2062169	623082
105	2543964	1993	Vocisano, Vincent	Woodlake Dr.	NA	170	20+	34795	2063191	621750
106	25322150	1988	Boyer Properties of NJ	Lot:15-16, Block:409	NA	20	NA	34813	2067280	631082
106	25322176	1988	Boyer Properties of NJ	Lot:15-16, Block:409	NA	20	NA	34813	2067280	631082
106	25304500	1987	Texize, Dow	Piscataway, No. 08854	NA	7	0	34813	2067280	631082
106	25322184	1988	Boyer Properties of NJ	Lot:15-16 Block:409	NA	17.5	NA	34813	2067280	631082
107	256715	1957	Bostas, James	Lot:18, Hamilton Blvd, Middlesex, NJ	NA	140	<5	34815	2066258	629750
108	2521522	1980	Janver Bldrs.	Woolworth Ave., S. Pffd Lot:5, Block:437	NA	125	40	34816	2067280	629750
108	2518953	1977	Global Development Cororation	South Plainfield, Middlesex Co.	NA	160	20	34816	2067280	629750
108	2518952	1988	Global Development	Lot:8 Block:437	NA	110	30	34816	2067280	629750
108	2518951	1977	Global Development	Lot:2D, Block:438	NA	100	20	34816	2067280	629750
108	2518950	1977	Global Development Corporation	Lot:2 Block:438	NA	140	30	34816	2067280	629750
108	2578949	1977	Global Development Corp.	Lot:1, Block:437	NA	130	25	34816	2067280	629750
108	2518948	1977	Global Development Corp.	Lot:09,Block:437	NA	50	20	34816	2067280	629750
108	259657	NA	Ice Palace, Co., Inc.	W. side of Hamilton Blvd., 1000' N of South Clinton Ave.	NA	310	75	34816	2067280	629750
108	454978	1996	DeGussa	3900 S. Clinton Ave., South Plainfield, NJ	NA	43	NA	34816	2067280	629750
109	2510547	1962	Couellesia, Patrick	South Plainfield, Middlesex, NJ	NA	197	5	34816	2066258	628416
110	4549251	1996	L. R. Metal Treating	3651 S. Clinton Ave.	NA	200	120	34819	2067280	628416
111	2532921	1989	Platina Labs	3601 S. Clinton Ave. South Plainfiend	NA	40	NA	34821	2068302	631082
111	2532920	1989	Platina Labs	3601 S. Clinton Ave. South Plainfield, NJ	NA	40	NA	34821	2068302	631082
111	2532191	1988	Platina Labs	3601 S. Clinton Ave., South Plainfield, N.J.	NA	35	NA	34821	2068302	631082
112	2520350	1978	Gaster, John	Lot:4, Block:353, South Plainfield., Middlesex Xo.	Na	100	30	34822	2069324	631082
113	2511472	1963	Yufik, Joseph	916 Arlington Ave., s. Plainfield, N.J.	NA	95	25	34824	2068302	629750
114	2521010	1979	Rothberg, Louis	Lot:5678, Block:477, Ryan St.	NA	300	15	34825	2069324	629750
115	258231	1959	Risoli, John	W. of easton # Blvd., & South of Hamilton Blvd.	NA	113	18	34827	2068302	628416
115	2523303	1981	Kearney Industries	2624 Hamilto Blvd.	NA	750	5	34827	2068302	628416
115	2523304	1981	Kearney Industries	2624 Hamilton Blvd. South PLainfield	NA	75	3	34827	2068302	628416
115	2523305	1981	Kearney Industries	2624 Hamilton Blvd.	NA	75	2	34827	2068302	628416
116	25324	1997	Atlas Oil Company	318 Durham Ave, S. Plainfield B.	NA	300	40	34828	2069324	628416
116	2526179	1986	Development Corp.	Lot:41.23 Block:70 Naraticong Trail, Readington, Hunterdon	NA	150	50	34828	2069324	628416
116	2526181	1980	Screnda, Inc.	Lot:4127 Block: 70 Municipality:Readington	NA	NA	NA	34828	2069324	628416

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

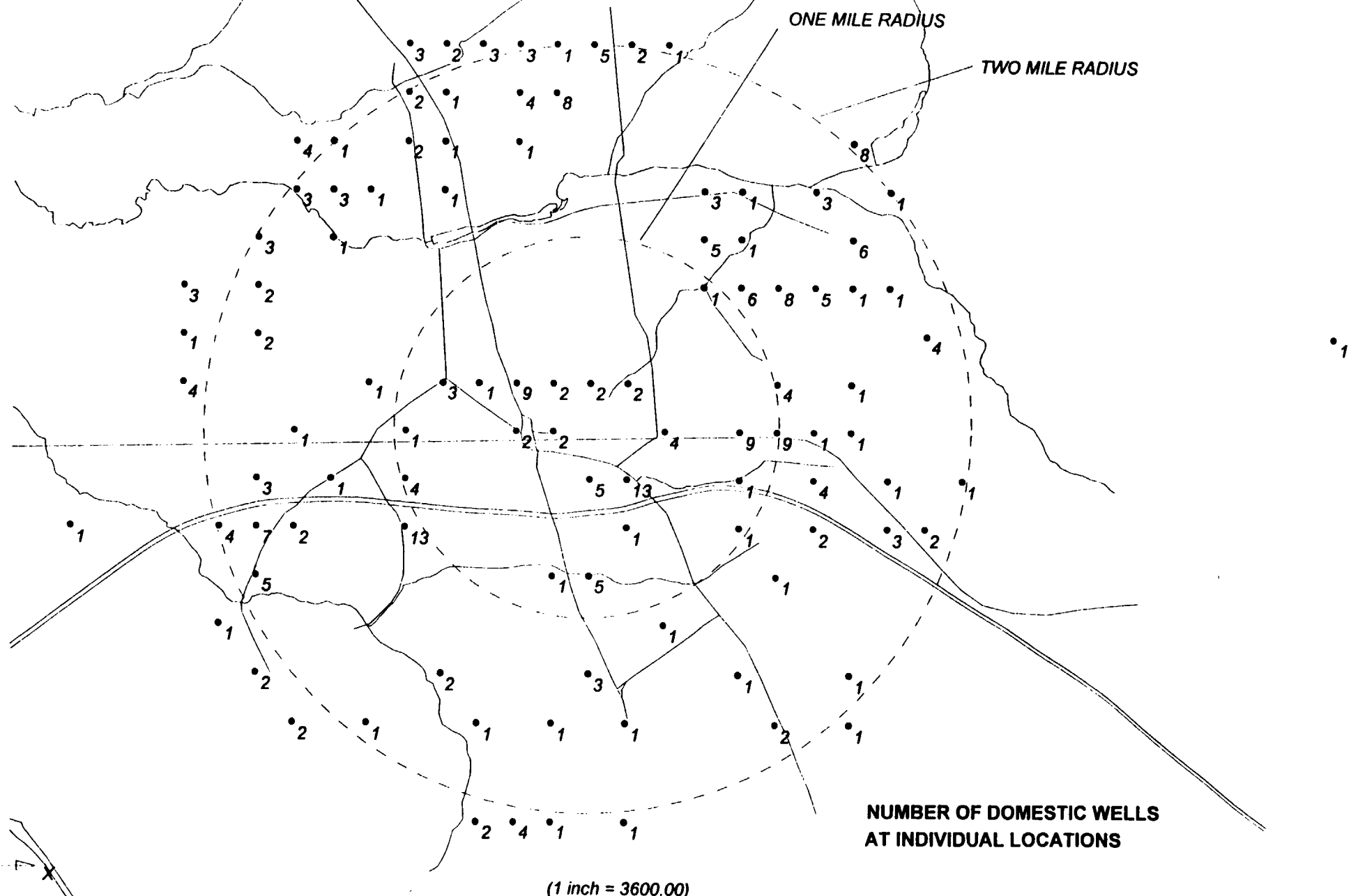
Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
117	2533861	1989	Myrush, Steve	101 West St. Middlesex	NA	50	10	34829	2070346	628416
118	2523946	1983	Sullivan, Sylvester	Lot: 7-8, Block: 55 Municipality: Somerville Boro	NA	175	60	34838	2072391	628416
119	2522849	1982	Rubino, Joseph	1328 Yurgel Dr., S. Plainfield, NJ	NA	320	20	34842	2066258	627082
120	253645	1954	Corp. of Engineers, U.S. Army	Plainfield, NJ	NA	281	27	34845	2066258	625750
121	258124	1958	Kowalski, Emil	Piscataway Township, Middlesex Co. N.J.	NA	123	15	34846	2067280	625750
122	2527530	1988	Gulf/Chevron, U.S.A.	Stelton and New Durham Rd., NJ	NA	10	NA	34848	2066258	624416
123	2526651	1985	Risoli, John F.	Lot: 4, Block: 537, Municipality: South Plainfield Boro	NA	275	15	34851	2068302	627082
123	2541341	1992	Seeman Development	86 Commonwealth Ave., Middlesex, NJ	NA	200	0	34851	2068302	627082
124	2520980	1979	Plfd. Curling Club	McKinney St. Lot: 1 Block: 488 S. Plfd.	NA	200	20+	34852	2069324	627082
124	2527117	1986	Pelmont Builders	Lot: 7679, Block: 774, Municipality: Piscataway Twp	NA	200	30	34852	2069324	627082
125	256846	1957	Gottis, Robert	S. Ave Plainfield, NJ	NA	124	3	34853	2070346	627082
125	2510099	NA	Tufaro, Vincent	Northwest corner of Pleasant Ave and Monroe Ave.	NA	145	12	34853	2070346	627082
125	2510101	NA	Lynq, Ralph U.	East side of Chimney Rock, 700ft S. of Gilbride Rd.	NA	190	5	34853	2070346	627082
126	25310542	1988	L-R Metal Treating	3651 S. Clinton Ave., S. Plainfield	NA	24.25	NA	34855	2069324	625750
126	25310551	1988	L-R Metal Treating	3651 S. Clinton Ave, S. Plainfield	NA	25	NA	34855	2069324	625750
127	2522442	1981	Carney Ltd., Federal Carbide	Lot: 2D, Bl: 21 New Durham Rd. Edison, NJ	NA	550	30	34856	2070346	625750
127	2527324	1986	Aromatics International Inc.	Lot: 45 Block: 734A Municipality: Piscataway	NA	505	4	34856	2070346	625750
127	25288750	1987	United States Land Resources	Lot: 3A12 Block: 55	NA	20	NA	34856	2070346	625750
127	25288768	1987	United States Land Resources	Lot: 3A12 Block: 55	NA	20	NA	34856	2070346	625750
127	2528877	1987	United States Land Resources	Lot: 3A12 Block: 55	NA	19	NA	34856	2070346	625750
128	2527116	1986	Pelmont Builders	Lot: 52 Block: 710 Municipality: Piscataway Twp.	NA	200	50	34858	2069324	624416
129	259733	1960	Tingley Rubber Co.	South Plainfield NJ	NA	428	266	34861	2071369	627082
129	256464	1957	Gubernat, John F.	Stelton, Middlesex	NA	150	10	34861	2071369	627082
130	2511197	1963	Biondella, David	Palisade Ave. Piscataway	NA	120	12	34872	2066258	623082
131	257251	1959	Lynor, E.M.	North Stelton, NJ	NA	440	<5	34876	2067280	621750
131	2516775	1973	Schwalje, Nicholas	School St., Piscataway Township, Middlesex Co., NJ Kilmer Sub Station	NA	224	4	34878	2067280	621750
132	2517306	1974	Breslin, James	Lot: 29-32, Block 156, Piscataway, Middlesex	NA	120	30	34882	2069324	623082
133	2520469	1979	Riedel Construction Co., Inc.	Lot: 6, Block: 705, Piscataway Twp., Somerset	NA	145	30	34884	2068302	621750
134	2518023	1975	De Paola, Joseph	Lot: 1-B, B1. Bl: 74, Piscataway, NJ	NA	150	20	34885	2069324	621750
135	2519327	1977	Sparacio, Joseph	Wickley Ave., Piscataway, NJ	NA	135	10	44121	2059102	619082
135	2519608	1977	Sparacio, Joseph	Wickley Ave, Piscataway, NJ	NA	125	10	44121	2059102	619082
136	259901	1961	Black, Lafayette W.	Zircle Ave., New Market	NA	90	10	44122	2060124	619082
136	2521000	1979	Greco, D	Orris Ave., Piscataway, NJ	NA	180	10	44122	2060124	619082
136	2527518	1986	Vocisano, Vincent	Lot: 13A Block: 737: Municipality: Piscataway, NJ	NA	190	30	44122	2060124	619082
136	2529446	1987	Vocisano, Dominick	lot: 9-10 Block: 736	NA	50	10	44122	2060124	619082
137	2525868	1985	Vocisano, Antonio	Lot: 13A Block: 737 Municipality: Piscataway Twp.	NA	190	10	44123	2061146	619082
138	2520180	1978	Agel, Catherine	Sheldon Place, Piscataway, NJ	NA	165	10	44132	2063191	619082

100241

10.0242



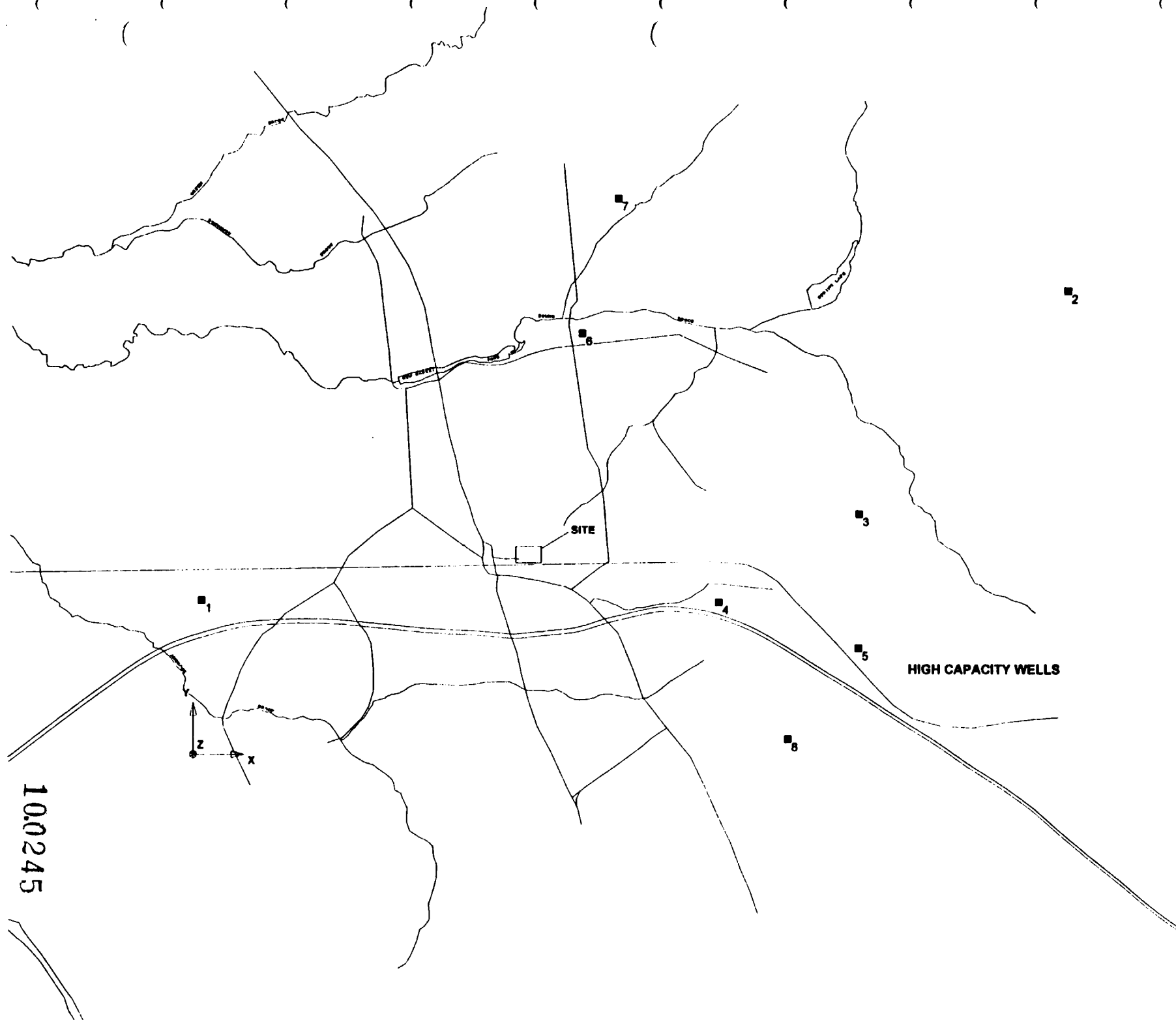
10.0243



**HIGH CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE**

Map Index	Permit No.	Owner	Well Name	Distance (miles)	Total Depth (ft.)	Geologic Unit	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
1	10215W	Captive Plastics	#1	1.9	240	GTRB	65	33929	2051946	628416
1	10215W	Captive Plastics	#2	1.9	230	GTRB	130	33929	2051946	628416
2	10247W	keystone Plastics	Well 2	1.9	300	GTRB	48	34654	2077502	637750
3	10660W	Jersey Concrete Co.	1	1.8	285	GTRB	87	34831	2071369	631082
3	10660W	Jersey Concrete Co.	2	1.8	340	GTRB	82	34831	2071369	631082
4	10929W	L.R. Metal Treating	1	1	200	GTRBP	100	34819	2067280	628416
5	2105P	Tingley Rubber Corporation	1	1.8	428	GTRB	200	34861	2071369	627082
6	2194P	Design and Molding Services	1	1.3	390	GRTB	120	34468	2063191	636416
6	2194P	Design and Molding Services	2	1.3	294	GTRB	120	34468	2063191	636416
7	5045	Elizabethtown Water Company	Clinton Av.	2	350	GTRB	450	34439	2064213	640416
8	MI0028	Coppola, Frank	POND	1.8	17	GTRB	300	34858	2069324	624416
8	MI0028	Coppola, Frank	Well 1	1.7	310	GTRB	100	34858	2069324	624416

100244



:
:
: **AFFIDAVIT OF**
: **WILLARD F. POTTER**
:

STATE OF NEW JERSEY)
)SS.:
COUNTY OF MORRIS)

WILLARD F. POTTER, being duly sworn, upon his oath,
deposes and says:

1. I am a Senior Project Director at *de maximis, inc.*,
which firm is principally engaged in the business of environmental
consulting.

2. In 1971, I obtained my B.S. in Chemical Engineering
from the University of Virginia. A copy of my resume is attached
hereto as Exhibit A.

3. I serve as the Facility Coordinator of the groundwater treatment plant at the Chemsol, Inc. Superfund Site (the "Site").

4. On or about October 30, 1996, Richard L. Fitament, Executive Director, and Kevin T. Aiello, Administrator, Environmental Quality, of the Middlesex County Utilities Authority ("MCUA") advised me that the MCUA would not accept any increased discharge flow from the groundwater treatment plant at the Site.

5. On or about March 10, 1997, Thomas Evans, Director, Piscataway Township Department of Public Works, advised me that use of the well located at the car wash on Stelton Road has been discontinued.

6. On or about September 3, 1997, Thomas Evans, Director, Piscataway Township Department of Public Works, advised me that, based on numerous site inspections of the well at the car wash on Stelton Road, the well continues not to be in use.

7. I have reviewed the proposed remedial actions evaluated in the Feasibility Study Report, Chemsol Inc. Superfund Site, June 1997 (the "FS") and described in the Superfund Proposed

Plan, Chemsol, Inc. Superfund Site, Piscataway, Middlesex County, New Jersey, August 1997.

8. Attached hereto as Exhibit B is a cost estimate I prepared for Alternative S-2A (Capping with Soil) that was evaluated in the FS.

9. The FS requires that clean common fill meeting New Jersey soil cleanup criteria be used for cover material for Alternative S-2A.

10. The FS requires that clean common fill meeting New Jersey soil cleanup criteria be used for backfill for Alternative S-3 (Excavation and Disposal).

11. Exhibit B uses a unit cost of \$5.33/cubic yard for soil cover material for Alternative S-2A, which unit cost was used for backfill in the cost estimate for Alternative S-3. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

12. Attached hereto as Exhibit C is a cost estimate I prepared for constructing Alternative S-2A over 5.73 acres of the Site using \$5.33/cubic yard for soil cover material. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

13. Attached hereto as Exhibit D is a cost estimate I prepared for disposal of the stockpiled soil excavated during the removal of the underground storage tank. The disposal quantity was obtained from the Feasibility Study Report, Chemsol, Inc. Superfund Site, June 1997, Appendix C. In my professional opinion, based on my experience, this cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

14. Attached hereto as Exhibit E is a cost estimate I prepared for constructing Alternative S-2A over 5.73 acres of the Site, using clean common fill at a unit cost of \$5.33/cubic yard,

disposing of those soils excavated during the removal of the underground storage tank, and using the remainder of the stockpiled soils as cover material. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

15. On or about September 26, 1997, I obtained a verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York, which estimate was \$300/cubic yard for transportation and disposal.

16. Attached hereto as Exhibit F is a cost estimate I prepared for Alternative S-3 using the verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the

Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

17. Using the analytical data presented in the Remedial Investigation Report, Chemsol, Inc. Superfund Site, October 1996, including, but not limited to, the figures presented in Appendix H, I estimate the additional soil volume that would be required to be excavated to achieve the State of New Jersey's PCB cleanup criterion of 0.49 ppm to be approximately 6,000 cubic yards.

18. Attached hereto as Exhibit G is a cost estimate I prepared for Alternative S-3 for excavating soil to achieve the State of New Jersey's PCB cleanup criterion and disposing of that soil at a nonhazardous waste landfill. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

19. Attached hereto as Exhibit H is a cost estimate I prepared for Alternative S-3 for excavating soil to achieve the State of New Jersey's PCB cleanup criterion and disposing of that


soil at a hazardous waste landfill, using the verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

20. The foregoing statements are made to the best of my knowledge and belief.



WILLARD F. POTTER

Sworn and subscribed to
before me this 10th day
of OCTOBER, 1997



Notary Public

JANET CLAYTER

NOTARY PUBLIC OF NEW JERSEY

Commission Expires 9/5/2001

10.0253

Willard F. Potter
Professional Qualifications

Mr. Potter is a Chemical Engineer with twenty five (25) years of diversified environmental project management and engineering experience in the industrial, regulatory and consulting areas. Mr. Potter was formerly Corporate Director of Hazardous Waste Control for Allied-Signal. He was responsible for all Superfund site investigations and negotiations with regulatory agencies. Mr. Potter represented Allied on numerous industry lead potentially responsible party (PRP) groups for Superfund National Priority List (NPL) sites.

As Vice President of Technical Litigation Support Services for Dunn Geoscience Corporation, Mr. Potter represented industrial clients during litigation involving environmental insurance coverage, acquisition and divestiture indemnification issues and agency negotiations.

Mr. Potter's project management experience includes Remedial Investigation/Feasibility Studies (RI/FS), waste minimization, remedial design, RCRA corrective action and development/implementation of an international inspection program for contract waste disposal facilities. His prior work experience also includes six (6) years with USEPA Region III in the NPDES permit program.

Education

B.S., Chemical Engineering, University of Virginia, Charlottesville, Virginia; 1971

Major Projects

- Primary Project Coordinator for PRP Group which conducted a RD/RA for a \$3.5MM groundwater treatment facility at a NPL solvent recycling facility in Region II. Activities/responsibilities include coordination and negotiation of work plans, day-to-day management of general contractor, contracting, financial management/tracking and regulatory liaison for PRP Committee. The treatment facility was completed on schedule and is now operating in compliance with permits. The facility design incorporated process automation and remote monitoring to minimize operator coverage.
- Primary Project Coordinator for PRP Group conducting a RD/RA of NPL municipal landfill in Region II. Activities include coordination of a supplemental hydrogeologic investigation to support the design of a groundwater extraction and reinjection system.

- Primary Project Coordinator for a PRP Group conducting a RD/RA of two related NPL sites in the New Jersey Pine Barrens Preservation District. Responsibilities include coordination and communications with multiple contractors, the PRP Group and the NJDEPE. Coordination of ecological assessments, modeling of potential ecological impacts from groundwater extraction and remedial design optimization a major activity. Other significant responsibilities include financial management/invoice review, progress reports, strategy development and public relations program support.
- Technical litigation and case management support for a lawsuit involving over \$50 million in environmental damage claims associated with contract of sale indemnification language. Activities include review and critique of proposed remedial activities and cost estimates, file searches, participation at depositions and expert witness testimony.
- Technical litigation and case management support in two (2) environmental insurance coverage lawsuits. Activities include file searches, regulatory research and interviews of potential expert witnesses.
- Original member of Chemical Manufacturers Association's Hazardous Waste Response Center. Activities included site inspections of six (6) NPL sites to provide EPA and State agencies with guidance on the conduct of Remedial Investigations. The group authored CMA's "Hazardous Waste Site Management Plan".
- Provided technical support to NJDEPE during remedial activities at an incineration facility on the NPL. Developed waste compatibility protocol for bulking of containerized waste material.
- Responsible for eight (8) ECRA investigations in New Jersey resulting from major corporate acquisition.
- Responsible for in-house guidance manuals and associated training on Superfund contracting, selection of outside laboratories, assessment of emerging remedial technologies and RI/FS planning activities.

10.0255

EXHIBIT B

**COST ESTIMATE FOR ALTERNATIVE S-2A
CAPPING WITH SOIL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	23,380		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Dumpsters	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,500		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and Dewatering	12 acres	36,000		
- Soil Cover	12 acres 12-in thick	103,200		
- Topsoil and Seed	12 acres 6-in thick	377,520	2,000	30,740
Subtotal		739,940	2,000	30,740
CONSTRUCTION SUBTOTAL		739,940	2,000	30,740
Health and Safety	10%	73,994		3,074
Bid Contingency	15%	110,991		4,611
Scope Contingency	30%	221,982		
CONSTRUCTION TOTAL		1,146,907	2,000	38,425
Permitting & Legal	5%	57,345		
Services During Construction	10%	114,691		
TOTAL IMPLEMENTATION COSTS		1,318,943		38,425
Engineering & Design	10%	131,894		
TOTAL ESTIMATED COSTS		1,450,837		38,425
NET PRESENT WORTH OF COSTS	\$1,489,262.36			

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.
2. Costs for soil cover are based on \$5.33/cy used by USEPA in Alternative S-3.

100256

10.0257

EXHIBIT C

**COST ESTIMATE FOR ALTERNATIVE S-2A
CAPPING WITH SOIL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	23,380		
- Baker Tank Sediment	95 drums	13,300		
- PPE	58 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Dumpsters	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,500		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and Dewatering	5.73 acres	17,190		
- Soil Cover	5.73 acres 12-in thick	49,300		
- Topsoil and Seed	5.73 acres 6-in thick	180,270	2,000	30,740
Subtotal		469,980	2,000	30,740
CONSTRUCTION SUBTOTAL		469,980	2,000	30,740
Health and Safety	10%	46,998		3,074
Bid Contingency	15%	70,497		4,611
Scope Contingency	30%	140,994		
CONSTRUCTION TOTAL		728,469	2,000	38,425
Permitting & Legal	5%	36,423		
Services During Construction	10%	72,847		
TOTAL IMPLEMENTATION COSTS		837,739		38,425
Engineering & Design	10%	83,774		
TOTAL ESTIMATED COSTS		921,513		38,425
NET PRESENT WORTH OF COSTS		\$959,938.29		

5% discount

1. Costs for offsite disposal are based on assumption that all soil and waste are disposed of at a non-TSCA facility.
2. Costs for soil cover are based on \$5.33/cy used by USEPA in Alternative S-3.

10.0258

EXHIBIT D

**COST ESTIMATE FOR
DISPOSAL OF STOCKPILED SOIL**

Item	Size or Quantity	Cost (\$)
Sampling and Analysis	2 Samples	4,000
Loading into Dumpsters	1 day	1,300
Transportation and Disposal	250 cy	17,500
TOTAL		\$22,800

1. Cost for sampling and analysis based on \$2,000 per sample and rate of 1 sample per 145 cy used in Alternative S-2A by USEPA.
2. Cost for loading into dumpsters based on \$1,300 per day and rate of 362.5 cy of soil loaded per day used in Alternative S-2A by USEPA.
3. Cost for transportation and disposal based on rate used in Alternative S-2A by USEPA and the excavated soil volume associated with the leaking underground storage tank (FS Appendix C).

10.0261

EXHIBIT E

**COST ESTIMATE FOR ALTERNATIVE S-2A
CAPPING WITH SOIL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	23,380		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	2	4,000		
- Loading onto Dumpsters	1 day	1,300		
- Transportation and Disposal	250 cy	17,500		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and Dewatering	5.73 acres	17,190		
- Soil Cover	5.73 acres 12-in thick	42,900		
- Topsoil and Seed	5.73 acres 6-in thick	180,270	2,000	30,740
Subtotal		359,680	2,000	30,740
CONSTRUCTION SUBTOTAL		359,680	2,000	30,740
Health and Safety	10%	35,968		3,074
Bid Contingency	15%	53,952		4,611
Scope Contingency	30%	107,904		
CONSTRUCTION TOTAL		557,504	2,000	38,425
Permitting & Legal	5%	27,875		
Services During Construction	10%	55,750		
TOTAL IMPLEMENTATION COSTS		641,130		38,425
Engineering & Design	10%	64,113		
TOTAL ESTIMATED COSTS		705,243		38,425
NET PRESENT WORTH OF COSTS	\$743,667.56			

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.
2. Costs for soil cover are based on \$5.33/cy used by USEPA in Alternative S-3.
3. Soil cover costs are reduced because 1,200 cy of stockpiled soil now assumed to be used as soil cover.

100262

10.0263

EXHIBIT F

**COST ESTIMATE FOR ALTERNATIVE S-3
EXCAVATION AND OFFSITE DISPOSAL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/Dewatering	1 ls	20,000		
- Excavation	18,500 cy	55,000		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	435,000		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	225	450,000		
- Offsite Transportation & Disposal	18,500 cy	5,550,000		
5. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil and Seed	12 acres 6-in	377,520		
Subtotal		7,430,780	0	0
CONSTRUCTION SUBTOTAL		7,430,780		0
Health and Safety	10%	743,078		0
Bid Contingency	15%	1,114,617		0
Scope Contingency	30%	2,229,234		
CONSTRUCTION TOTAL		11,517,709	0	0
Permitting & Legal	5%	575,885		
Services During Construction	10%	1,151,771		
TOTAL IMPLEMENTATION COSTS		13,245,365		0
Engineering & Design	10%	1,324,537		
TOTAL ESTIMATED COSTS		14,569,902		0
NET PRESENT WORTH OF COSTS		\$14,569,902		

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a RCRA facility @ \$300/cy.
2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.
3. Apparent FS error in well cuttings disposal cost maintained for consistency.

10.0264

10.0265

EXHIBIT G

**COST ESTIMATE FOR ALTERNATIVE S-3
EXCAVATION AND OFFSITE DISPOSAL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/Dewatering	1 ls	20,000		
- Excavation	24,500 cy	72,770		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,500		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	298	596,000		
- Offsite Transportation & Disposal	24,500 cy	1,715,000		
5. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil and Seed	12 acres 6-in	377,520		
Subtotal		3,426,050	0	0
CONSTRUCTION SUBTOTAL		3,426,050		0
Health and Safety	10%	342,605		0
Bid Contingency	15%	513,908		0
Scope Contingency	30%	1,027,815		
CONSTRUCTION TOTAL		5,310,378	0	0
Permitting & Legal	5%	265,519		
Services During Construction	10%	531,038		
TOTAL IMPLEMENTATION COSTS		6,106,934		0
Engineering & Design	10%	610,693		
TOTAL ESTIMATED COSTS		6,717,628		0
NET PRESENT WORTH OF COSTS	\$6,717,628			

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.
2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.
3. 6,000 cy additional soil for sampling and offsite disposal.
4. Apparent FS error in well cuttings disposal cost maintained for consistency.

10.0267

EXHIBIT H

**COST ESTIMATE FOR ALTERNATIVE S-3
EXCAVATION AND OFFSITE DISPOSAL**

Item	Size or Quantity	Capital Costs (\$)	O&M Costs(\$)	
			Annual	Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/Dewatering	1 ls	20,000		
- Excavation	24,500 cy	72,770		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	435,000		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	298	596,000		
- Offsite Transportation & Disposal	24,500 cy	7,350,000		
5. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil and Seed	12 acres 6-in	377,520		
Subtotal		9,394,550	0	0
CONSTRUCTION SUBTOTAL		9,394,550		0
Health and Safety	10%	939,455		0
Bid Contingency	15%	1,409,183		0
Scope Contingency	30%	2,818,365		
CONSTRUCTION TOTAL		14,561,553	0	0
Permitting & Legal	5%	728,078		
Services During Construction	10%	1,456,155		
TOTAL IMPLEMENTATION COSTS		16,745,785		0
Engineering & Design	10%	1,674,579		
TOTAL ESTIMATED COSTS		18,420,364		0
NET PRESENT WORTH OF COSTS		\$18,420,364		

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a RCRA facility @ \$300/cy.
2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.
3. 6,000 cy additional soil for sampling and offsite disposal.
4. Apparent FS error in well cuttings disposal cost maintained for consistency.

10.0268

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - B

**Written comments received by EPA during the
public comment period**

CHEMSOL TREATMENT SYSTEM
INITIAL STUDY - EFFLUENT CHRONIC TOXICITY

Prepared by
Bigler Associates, Inc.

September 9, 1996

Introduction

The purpose of this study was to determine if the Chemsol Treatment Plant effluent could meet the proposed surface water discharge requirements for Chronic Toxicity, and what if any pretreatment of the effluent would be required to achieve compliance. Since start up of the facility, no Acute or Chronic Toxicity testing of the effluent has ever taken place. Aqua Survey, Inc. of Flemington, NJ was selected as the contract laboratory to run the Chronic Toxicity testing. Bigler Associates supervised the project, ran on site testing and pretreatment of the split samples.

Chronic Toxicity

The Chronic Toxicity test is used to determine the effect of the discharge on aquatic biota. Aquatic organisms are exposed to various concentrations of the treatment system effluent for a six or seven day period (depending on type of organism used). After the exposure, observations are made regarding the organisms' survival rate, weight gain, reproductive ability, and other indicators of health of the organism. The data is compared to a control group and statistical analysis is performed.

Measurement of the chronic toxicity is reported several ways as follows.

NOEC : No-observed-effect concentration - the highest toxicant concentration in which the values for the measured parameters (weight, survival, reproduction, etc.) are not significantly different from the control. A high NOEC value indicates low Chronic Toxicity.

LOEC : Lowest-observed-effect concentration - the lowest toxicant concentration in the values for the measured parameters are statistically significantly different from the control. A high LOEC value indicates low Chronic Toxicity.



IC₂₅ : Incipient Concentration 25% - The concentration of effluent which produced a chronic toxic effect on 25% of the organisms as compared to the control group. A high IC₂₅ value indicates low Chronic Toxicity.

The proposed surface water discharge limitations include an NOEC limit of 100% (the lowest possible measured Chronic Toxicity) for two test organisms. The organisms tested are the Fathead minnow (Pimephales promelas) 7 day larval survival and growth test, and Cladoceran (Ceriodaphnia dubia) 3 brood survival and reproduction test. Simultaneous split sample tests are run on both organisms and the more stringent results apply to the permit.

Chemsol Effluent Testing

In order to determine if the effluent could meet the strict requirements indicated in the permit equivalent, a full set of toxicity testing was run. Since the persistent presence of Hydrogen Sulfide (H₂S) in the effluent was a concern regarding the Chronic Toxicity, two sets of samples were run to determine if removal of the H₂S was necessary. One set was labeled "untreated effluent" and consisted of samples collected during the week period that were delivered to the lab untreated. The second set of samples labeled "treated effluent" consisted of samples that were treated with 0.5 mg/L Hydrogen Peroxide and 45 minutes of aeration to remove any Hydrogen Sulfide.

Routine testing of the over the past two years indicated that the H₂S concentration in the effluent is typically 2.5 mg/L. BAI performed bench testing of the effluent with Hydrogen Peroxide and aeration and determined the normal dosage requirements for oxidation of H₂S. Once the samples were collected for the Toxicity test, they were tested on site to determine the concentration of H₂S before treatment and delivery to the laboratory. The results indicated that no H₂S was present in the sample after collection, although a grab sample of the effluent was measured with 2.1 mg/L H₂S. This absence of Hydrogen Sulfide was attributed to the method of sample collection which relied on sample flowing at a slow rate into an open container. The long detention time in the shallow container allowed for atmospheric oxidation of the H₂S. It was decided to treat one set of samples with a minimum dosage of Hydrogen Peroxide and continue to determine if there would be any positive effect from the pretreatment, since the peroxide would also oxidize many organic compounds that may remain.

Test Results

The following table summarizes the results of tests contained in the attached reports.

Sample	Organism	NOEC	LOEC	IC ₂₅
Untreated Eff.	<i>C. dubia</i>	100.0%	>100%	>100%
Untreated Eff.	<i>P. promelas</i>	100.0%	>100%	>100%
Treated Eff.	<i>C. dubia</i>	12.5%	25.0%	26.7%



Treated Eff.	<i>P. promelas</i>	100.0%	>100%	>100%
--------------	--------------------	--------	-------	-------

The above results indicate that the untreated sample demonstrated no Chronic Toxicity in either species tested. The treated sample showed no Chronic Toxicity in the Fathead minnow, but toxicity was indicated with the daphnia in this sample. It is likely that even at 0.5 mg/L the Hydrogen Peroxide concentration was too great for this organism, however based on this one test, pretreatment of the effluent with Hydrogen Peroxide to remove Hydrogen Sulfide is not needed.

Recommendations

To verify the results, BAI recommends that the Chronic Toxicity test be repeated at least one more time on the untreated effluent. Consideration should also be given to running an additional test on effluent from a clean carbon bed to determine if the biological activity in the carbon unit is responsible for positive results. BAI would also recommend a post aeration system be added to the existing effluent tank to facilitate stripping of residual H₂S if discharge to surface water becomes a viable alternative.



①

CHRONIC BIOMONITORING REPORT

Chemsol Plant
Pimephales promelas
(Untreated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

100273



**NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS**

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.ACUTE TOXICITY ID./CERTIFICATION #: 10309DATE OF LAST SRT TEST: 7/22/96NOEC/IC₂₅: 0.5 ppt KCl / 0.56CONTROL CHART MEAN(NOEC/IC₂₅): 0.35/0.60UPPER CONTROL LIMIT: 0.70/0.89LOWER CONTROL LIMIT: 0.18/0.33TEST START DATE: 8/13/96TEST END DATE: 8/20/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

<input checked="" type="checkbox"/>	Fathead minnow, (CN/FM) Method 1000.0 (<u>Pimephales promelas</u>) 7 day Larval Survival and Growth Test	NOEC: <u>100%</u>	LOEC: <u>>100%</u>	IC ₂₅ : <u>>100%</u>
<input type="checkbox"/>	Cladoceran, (CN/CD) Method 1002.0 (<u>Ceriodaphnia dubia</u>) 3 brood Survival and Reproduction Test	NOEC	LOEC	
<input type="checkbox"/>	Sheepshead minnow, (CN/SM) Method 1005.0 (<u>Cyprinodon variegatus</u>) 7 day Larval Survival and Growth Test	NOEC	LOEC	
<input type="checkbox"/>	Inland Silverside, (CN/IS) Method 1006.0 (<u>Menidia beryllina</u>) 7 day Larval Survival and Growth Test	NOEC	LOEC	
<input type="checkbox"/>	Mysid, (CN/MS) Method 1007.0 (<u>Mysidopsis bahia</u>) 7 day Survival, Growth and Fecundity Test	NOEC	LOEC	
<input type="checkbox"/>	Alga, (CN/SC) Method 1003.0 (<u>Selenastrum capricornutum</u>) Growth Test	NOEC	LOEC	
<input type="checkbox"/>	Macroalga, (CN/CP) Method 1009.0 (<u>Champia parvula</u>) Sexual Reproduction Test	NOEC	LOEC	

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes ☒ No ☐

CERTIFICATION:

Accuracy of report certified by:

York Terrell
 York Terrell
 Project Manager

9/15/96
 Date

TEST DESIGN

100274



Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 4
 Number of Test Organisms per Replicate: 10
 Number of Test Organisms per Test Concentration: 40

Test Chamber Size: 1000 mL

Exposure Volume: 500 mL

Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite ☒ Other ☐ Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	6.7	7.3	8/13-14	3:00 pm
8/13 - 8:00 am	8/14 - 8:00 am	5.7	7.2	8/15-16	2:30 pm
8/15 - 8:00 am	8/16 - 8:00 am	6.0	7.4	8/17-19	9:00 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

**SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW,
INLAND SILVERSIDE AND MYSID TESTS**

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	100.0	0.608	
6.25	90.0	0.565	
12.5	95.0	0.573	
25	92.5	0.555	
50	95.0	0.660	
100	97.5	0.625	

Organism source: ☒ Cultured Stock ☐ Commercial Supplier

Name of Supplier:

Hatch Dates: 8/12/96

Organism Age (days/hrs.): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? ☒ Yes ☐ No

Did the temperature in the test chambers vary by more than 1°C each day?
☒ Yes ☐ No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
☐ Yes ☐ No

*How long after test termination were the mysids examined for eggs and sexes? ☐

* Applies to mysid test only

A

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10.0277

**AQUA SURVEY, INC.
CHRONIC DEPARTMENT**

GENERAL INFORMATION

Job #: 96-294 (u) Test Exposure Volume: 500 ml
 Client: BLR untreated Dilution Water: 100% Recor
 Organism: P. Brown. Age: <24 hr.
 Test Temperature: 25 \pm 1 $^{\circ}$ C
 Stocked By: ES Initial Count Checked By: ES
 Test Start Date: 8/13/96 Time: 3 PM
 Test End Date: 8/20/96 Time: 11⁰⁰ AM
 Water Bath #: /

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
74328			6.7	7.3	8/13/96	3 PM
74328			—	—	8/14/96	2 PM
7455B			5.7	7.2	8/15/96	2 ³⁰ PM
7455B 7490B			—	—	8/16/96	3 ³⁰ PM
7490B			6.0	7.4	8/17/96	9 AM
7496B					8/18/96	9 ⁴⁰ AM
7490B					8/19	9:45 AM

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>60</u>	<u>84</u>
	100%	<u>180</u>	<u>208</u>
Sample #2	Control	<u>60</u>	<u>96</u>
	100%	<u>168</u>	<u>232</u>
Sample #3	Control	<u>80</u>	<u>112</u>
	100%	<u>176</u>	<u>312</u>

100278

AQUA SURVEY, INC.
CHRONIC STUDIES DEPARTMENT
LIVE COUNT

Job #: 96-294 (u)
Chronic

Organisms: P. promelas

Date	TEST DAY								Additional Information/Corrections
	0	1	2	3	4	5	6	7	
8/1	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
8/2	10	10	9'	9	9	9	9	9	
B	10	10	10	10	10	9'	9	8	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	9'	9	
8/3	10	10	10	10	10	10	10	10	
B	10	10	9'	9	9	9	9	9	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	9'	9	9	
8/4	10	10	10	10	10	10	8 ²	8	
B	10	10	10	10	10	10	10	9	emphs reversed
C	10	10	10	10	10	9'	9	10	on 8/19 EV 5/10
D	10	10	10	10	10	10	10	10	
8/5	10	10	10	10	10	10	10	10	
B	10	10	10	9'	9	9	9	9	
C	10	10	10	10	10	10	10	10	
D	10	10	10	9'	9	9	9	9	
8/6	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	9'	9	9	9	9	
8/7									
B									
C									
D									
Initial	ES	ES	EL	YT	ES	ES	ES	EL	
Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	

Superscript numbers in live count box = number of dead bottles

100279

Chemsol 96-294 untreated P. promelas Survival
File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.184

W = 0.967

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Chemsol 96-294 untreated P. promelas Survival
File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance
Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: Chemsol 96-294 untreated P. promelas Survival

FILE: 294upps

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	1.0000	1.4120
1	Control	2	1.0000	1.4120
1	Control	3	1.0000	1.4120
1	Control	4	1.0000	1.4120
2	6.25	1	0.9000	1.2490
2	6.25	2	0.8000	1.1071
2	6.25	3	1.0000	1.4120
2	6.25	4	0.9000	1.2490
3	12.5	1	1.0000	1.4120
3	12.5	2	0.9000	1.2490
3	12.5	3	1.0000	1.4120
3	12.5	4	0.9000	1.2490
4	25	1	0.8000	1.1071
4	25	2	1.0000	1.4120
4	25	3	0.9000	1.2490
4	25	4	1.0000	1.4120
5	50	1	1.0000	1.4120
5	50	2	0.9000	1.2490
5	50	3	1.0000	1.4120
5	50	4	0.9000	1.2490
6	100	1	1.0000	1.4120
6	100	2	1.0000	1.4120
6	100	3	1.0000	1.4120
6	100	4	0.9000	1.2490

10.0281

Chemsol 96-294 untreated P. promelas Survival
 File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	1.412	1.412	1.412
2	6.25	4	1.107	1.412	1.254
3	12.5	4	1.249	1.412	1.331
4	25	4	1.107	1.412	1.295
5	50	4	1.249	1.412	1.331
6	100	4	1.249	1.412	1.371

Chemsol 96-294 untreated P. promelas Survival
 File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.000	0.000	0.000	0.00
2	6.25	0.016	0.125	0.062	9.93
3	12.5	0.009	0.094	0.047	7.07
4	25	0.022	0.147	0.073	11.35
5	50	0.009	0.094	0.047	7.07
6	100	0.007	0.081	0.041	5.94

100282

2/25/96

Chemsol 96-294 untreated P. promelas Survival
 File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST

- Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Control	1.412				
2	6.25	1.254	12.00	10.00	4.00	
3	12.5	1.331	14.00	10.00	4.00	
4	25	1.295	14.00	10.00	4.00	
5	50	1.331	14.00	10.00	4.00	
6	100	1.371	16.00	10.00	4.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

Job #: 96-294 (u)
Facility: ~~B-1~~ (un treated)

Organism: *P. promelas*

Balance: 5000

Task	Date	Time	Initials
Organisms to pen	8/20/96	11:40 AM	EL
Pans placed in Oven	8/20/96	1:30 PM	EL
Pans placed in desiccator	8/21/96	8:00 AM	EL
Temperature			

Additional Information/Corrections

(D) 1.3439 EC 5/23/86

- 10.0284

Chemsol 96-294 Untreated P. promelas Dry Weight
File: 294uppdw Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.053

W = 0.968

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Chemsol 96-294 Untreated P. promelas Dry Weight
File: 294uppdw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 3.53

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

10.0285

57

TITLE: Chemsol 96-294 Untreated P. promelas Dry Weight

FILE: 294uppdw

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.6100	0.6100
1	Control	2	0.6800	0.6800
1	Control	3	0.5500	0.5500
1	Control	4	0.5900	0.5900
2	6.25	1	0.5500	0.5500
2	6.25	2	0.4900	0.4900
2	6.25	3	0.5400	0.5400
2	6.25	4	0.6800	0.6800
3	12.5	1	0.5400	0.5400
3	12.5	2	0.5700	0.5700
3	12.5	3	0.5700	0.5700
3	12.5	4	0.6100	0.6100
4	25	1	0.5400	0.5400
4	25	2	0.5900	0.5900
4	25	3	0.4800	0.4800
4	25	4	0.6100	0.6100
5	50	1	0.6700	0.6700
5	50	2	0.6200	0.6200
5	50	3	0.7000	0.7000
5	50	4	0.6500	0.6500
6	100	1	0.6400	0.6400
6	100	2	0.5600	0.5600
6	100	3	0.6900	0.6900
6	100	4	0.6100	0.6100

100286

Chemsol 96-294 Untreated P. promelas Dry Weight
File: 294uppdw Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	0.550	0.680	0.608
2	6.25	4	0.490	0.680	0.565
3	12.5	4	0.540	0.610	0.573
4	25	4	0.480	0.610	0.555
5	50	4	0.620	0.700	0.660
6	100	4	0.560	0.690	0.625

Chemsol 96-294 Untreated P. promelas Dry Weight
File: 294uppdw Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.003	0.054	0.027	8.95
2	6.25	0.007	0.081	0.041	14.34
3	12.5	0.001	0.029	0.014	5.02
4	25	0.003	0.058	0.029	10.45
5	50	0.001	0.034	0.017	5.10
6	100	0.003	0.054	0.027	8.71

10.0287

2/2
4/1

Chemsol 96-294 Untreated P. promelas Dry Weight
File: 294uppdw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.033	0.007	2.223
Within (Error)	18	0.053	0.003	
Total	23	0.086		

Critical F value = 2.77 (0.05,5,18)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

10.0288

9/9

Chemsol 96-294 Untreated P. promelas Dry Weight
 File: 294uppdw Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.608	0.608		
2	6.25	0.565	0.565	1.103	
3	12.5	0.573	0.573	0.908	
4	25	0.555	0.555	1.363	
5	50	0.660	0.660	-1.363	
6	100	0.625	0.625	-0.454	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

Chemsol 96-294 Untreated P. promelas Dry Weight
 File: 294uppdw Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	6.25	4	0.093	15.3	0.043
3	12.5	4	0.093	15.3	0.035
4	25	4	0.093	15.3	0.053
5	50	4	0.093	15.3	-0.052
6	100	4	0.093	15.3	-0.017

10.0289

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.61	.55	.54	.54	.67	.64
Response 2	.68	.49	.57	.59	.62	.56
Response 3	.55	.54	.57	.48	.7	.69
Response 4	.59	.68	.61	.61	.65	.61

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Effluent

Test Start Date: 8/13/96 Test Ending Date: 8/20/96

Test Species: P. promelas

Test Duration: 7

DATA FILE: 294uppdw.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.608	0.054	0.608
2	4	6.250	0.565	0.081	0.596
3	4	12.500	0.573	0.029	0.596
4	4	25.000	0.555	0.058	0.596
5	4	50.000	0.660	0.034	0.596
6	4	100.000	0.625	0.054	0.596

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

100290

OK
9/1

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/13/96	11:01:50	ECU	24.75	321.00	0.2	7.32	7.76
8/13/96	11:01:57	6.25	24.91	339.00	0.2	7.54	7.73
8/13/96	11:02:05	12.5	24.95	350.00	0.2	7.34	7.71
8/13/96	11:02:13	75	24.96	373.00	0.2	7.68	7.66
8/13/96	11:02:21	50	24.82	414.00	0.2	7.32	7.56
8/13/96	11:02:33	100	24.82	510.00	0.2	7.14	7.37

EC 8/14/96

100291

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	9:46:31	<i>can</i>	24.41	335.00	0.2	7.62	8.42
8/14/96	9:46:37	<i>6.25</i>	24.65	347.00	0.2	7.65	8.25
8/14/96	9:46:42	<i>1.5</i>	24.62	358.00	0.2	7.90	8.19
8/14/96	9:46:49	<i>25</i>	24.64	380.00	0.2	7.88	8.10
8/14/96	9:46:56	<i>50</i>	24.68	428.00	0.2	7.90	7.97
8/14/96	9:47:04	<i>100</i>	24.72	523.00	0.2	7.67	7.81

CC 8/14/96

100292

YSI 6000 Time Series Report

Page :

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:03:59	24.09	326.00	0.2	8.75	8.46
8/15/96	10:04:11	24.88	345.00	0.2	7.70	7.90
8/15/96	10:04:18	24.91	360.00	0.2	7.71	7.86
8/15/96	10:04:24	24.95	393.00	0.2	7.70	7.79
8/15/96	10:04:30	25.00	465.00	0.2	7.68	7.68
8/15/96	10:04:37	25.08	608.00	0.3	7.65	7.52

10.0293

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	10:24:06	6.25	24.06	332.00	0.2	8.70	8.60
8/16/96	10:24:14	6.25	24.63	348.00	0.2	8.02	8.38
8/16/96	10:24:20	1.15	24.69	364.00	0.2	8.07	8.27
8/16/96	10:24:27	2.5	24.72	396.00	0.2	8.05	8.16
8/16/96	10:24:33	5.0	24.71	464.00	0.2	8.00	8.04
8/16/96	10:24:39	1.0	24.66	600.00	0.3	7.92	7.87

SL 816196

10.0294

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	8:09:27	24.44	304.00	0.2	7.51	8.19
8/17/96	8:09:43	24.52	322.00	0.2	7.72	8.08
8/17/96	8:09:52	24.56	338.00	0.2	7.72	8.02
8/17/96	8:10:02	24.59	366.00	0.2	7.74	7.95
8/17/96	8:10:09	24.59	429.00	0.2	7.76	7.85
8/17/96	8:10:21	24.62	552.00	0.3	7.73	7.64

100295

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:23:38	24.71	314.00	0.2	8.03	8.01
8/18/96	9:23:50	24.81	339.00	0.2	7.91	7.97
8/18/96	9:24:00	24.92	344.00	0.2	8.06	7.90
8/18/96	9:24:09	25.05	381.00	0.2	8.10	7.84
8/18/96	9:24:19	25.15	440.00	0.2	8.00	7.76
8/18/96	9:24:32	25.36	568.00	0.3	7.93	7.55

10.0296

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:50:17	24.87	321.00	0.2	7.43	8.35
8/19/96	9:50:24	25.37	336.00	0.2	7.64	8.03
8/19/96	9:50:30	25.35	344.00	0.2	7.64	7.98
8/19/96	9:50:35	25.30	381.00	0.2	7.65	7.92
8/19/96	9:50:40	25.31	440.00	0.2	7.66	7.84
8/19/96	9:50:47	25.44	572.00	0.3	7.65	7.66

100297

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	10:12:03	6.21	24.70	355.00	0.2	7.71	8.42
8/14/96	10:12:12	6.25	25.70	373.00	0.2	6.65	8.03
8/14/96	10:12:19	12.5	25.95	377.00	0.2	6.69	7.91
8/14/96	10:12:35	25	24.86	402.00	0.2	7.13	8.06
8/14/96	10:12:42	50	25.42	448.00	0.2	6.80	7.90
8/14/96	10:12:50	100	25.87	542.00	0.3	6.62	7.78

[C 8/14/96]

10.0298

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:19:28	6.50	24.37	345.00	0.2	7.51	8.01
8/15/96	10:19:35	6.45	24.95	351.00	0.2	6.80	7.77
8/15/96	10:19:42	1.15	24.95	364.00	0.2	6.79	7.72
8/15/96	10:19:48	2.75	24.94	387.00	0.2	6.77	7.64
8/15/96	10:19:54	5.2	24.93	435.00	0.2	6.26	7.57
8/15/96	10:19:59	6.0	24.93	523.00	0.2	6.18	7.53

SC 8/15/96

100299

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	11:52:22	<i>eu</i>	24.07	374.00	0.2	7.15	8.58
8/16/96	11:52:29	<i>G-15</i>	24.79	368.00	0.2	5.30	8.14
8/16/96	11:52:35	<i>125</i>	24.79	381.00	0.2	5.23	8.06
8/16/96	11:52:41	<i>25</i>	24.78	414.00	0.2	5.25	7.96
8/16/96	11:52:48	<i>50</i>	24.77	483.00	0.2	5.06	7.87
8/16/96	11:52:54	<i>100</i>	24.73	621.00	0.3	4.90	7.81

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100300

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	7:45:12	25.06	323.00	0.2	7.12	6.84
8/17/96	7:45:28	25.07	347.00	0.2	6.84	6.91
8/17/96	7:45:36	25.51	363.00	0.2	6.51	6.90
8/17/96	7:45:41	25.65	397.00	0.2	6.31	6.90
8/17/96	7:45:50	25.75	462.00	0.2	6.00	6.87
8/17/96	7:45:58	25.72	596.00	0.3	5.60	6.88

10.0301

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:03:27	24.10	345.00	0.2	7.50	8.48
8/18/96	9:03:34	24.92	349.00	0.2	6.07	8.14
8/18/96	9:03:47	25.06	367.00	0.2	5.95	7.98
8/18/96	9:03:54	25.08	391.00	0.2	5.97	7.90
8/18/96	9:04:00	25.09	454.00	0.2	5.89	7.85
8/18/96	9:04:06	25.04	576.00	0.3	5.76	7.77

10.0302

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:19:44	25.58	346.00	0.2	5.38	7.78
8/19/96	9:19:54	25.55	367.00	0.2	5.16	7.54
8/19/96	9:20:00	25.60	382.00	0.2	5.12	7.49
8/19/96	9:20:06	25.62	398.00	0.2	5.09	7.46
8/19/96	9:20:11	25.59	454.00	0.2	5.07	7.40
8/19/96	9:20:17	25.52	585.00	0.3	4.87	7.35

10.0303

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/20/96	8:58:33	24.61	373.00	0.2	6.31	8.20
8/20/96	8:58:48	24.75	368.00	0.2	5.77	7.87
8/20/96	8:59:00	24.78	376.00	0.2	5.78	7.80
8/20/96	8:59:10	24.76	406.00	0.2	5.48	7.74
8/20/96	8:59:19	24.71	468.00	0.2	5.20	7.69
8/20/96	8:59:32	24.60	599.00	0.3	4.98	7.65

100304

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 6-13-96

TEST JOB#: 96-294

CLIENT: BA

TEST LOCATION: IN-LAB [/]

FIELD []

TEST SPECIES: P. domoica

TOTAL NUMBER ORGANISMS TRANSFERRED: 4807

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: EL

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: Holt Unit

2. RECEIVING LOG #: void

3. CULTURE LOG #: 96-0475

4. AGE/SIZE INFORMATION: 524 1/2 LBS MD 6-12-96

B. HOLDING [] CULTURE [/] WATER PARAMETERS

1. TEMPERATURE: 25.0°C

2. SALINITY: void

3. WATER SOURCE: 100% Recirc

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 6-13-96

TIME: 1400 hr

BY: EL

2. LIVESTOCK RECEIVING DATE: 6-13-96

TIME: 1400 hr

BY: EL

3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EL

REMARKS: (6) m2 1/2

10.0305

②

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Ceriodaphnia dubia
(Untreated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

100306



NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.

ACUTE TOXICITY ID./CERTIFICATION #: 10309

DATE OF LAST SRT TEST: 7/15/96

NOEC/IC₂₅: 0.25 ppt KCl / 0.34CONTROL CHART MEAN(NOEC/IC₂₅: 0.225/0.31

UPPER CONTROL LIMIT: 0.45/0.46

LOWER CONTROL LIMIT: 0.11/0.16

TEST START DATE: 8/13/96

TEST END DATE: 8/19/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

- Fathead minnow, (CN/FM) NOEC LOEC
Method 1000.0 (*Pimephales promelas*) 7 day Larval Survival and Growth Test
- X Cladoceran, (CN/CD) NOEC/IC₂₅: 100%/>100% LOEC: >100%
Method 1002.0 (*Ceriodaphnia dubia*) 3 brood Survival and Reproduction Test
- Sheepshead minnow, (CN/SM) NOEC LOEC
Method 1005.0 (*Cyprinodon variegatus*) 7 day Larval Survival and Growth Test
- Inland Silverside, (CN/IS) NOEC LOEC
Method 1006.0 (*Menidia beryllina*) 7 day Larval Survival and Growth Test
- Mysid, (CN/MS) NOEC LOEC
Method 1007.0 (*Mysidopsis bahia*) 7 day Survival, Growth and Fecundity Test
- Alga, (CN/SC) NOEC LOEC
Method 1003.0 (*Selenastrum capricornutum*) Growth Test
- Macroalga, (CN/CP) NOEC LOEC
Method 1009.0 (*Champia parvula*) Sexual Reproduction Test

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes ☒No ☐

CERTIFICATION:

Accuracy of report certified by:


York Terrell
Project Manager9/5/96
Date

TEST DESIGN

Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 10
 Number of Test Organisms per Replicate: 1
 Number of Test Organisms per Test Concentration: 10
 Test Chamber Size: 30 mL Exposure Volume: 15 mL
 Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite ☒ Other ☐ Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	6.7	7.3	8/13-14	11:30 am
8/13 - 8:00 am	8/14 - 8:00 am	5.7	7.2	8/15-16	11:10 am
8/15 - 8:00 am	8/16 - 8:00 am	6.0	7.4	8/17-18	9:30 am

Maximum holding time of any effluent sample 72 hrs.Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

**SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST**

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	18.0	70.0
6.25	100	24.0	100
12.5	100	21.8	77.8
25	100	24.6	90
50	100	21.8	60
100	100	27.0	80

Organism source: ☒ Cultured Stock ☐ Commercial Supplier

Name of Supplier:

Organism Age at test start (hrs.): <24 hrs.

Test organisms all released with an 8 hour period? ☒ Yes ☐ No

Neonates obtained from (check one):

☐ Mass cultures

☒ individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood? ☒ Yes ☐ No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippia

Percent Effluent	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrations influence the determination of the NOEC/IC25?

☐ Yes

☒ No

A

P

P

E

N

D

I

X

10.0310

AQUA SURVEY, INC.
CHRONIC DEPARTMENT

GENERAL INFORMATION

Job #: 96-294 (a) Test Exposure Volume: 15 ml
 Client: BAR (untreated) Dilution Water: 100% Recar
 Organism: C. dubia Age: < 24 Hr.
 Test Temperature: 25 ± 1°C
 Stocked By: EC Initial Count Checked By: EC
 Test Start Date: 8/13/96 Time: 11:22 am
 Test End Date: 8/19/96 Time: 2:00 pm
 Water Bath #: 1

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
7432 B			6.7	7.3	8/13/96	11:30 am
7432 B			—	—	8/14/96	10:53 am
7455 B			5.7 7.5 ^{2.5}	8.6 ^{1.2}	8/15/96	11:44 am
7455 B			—	—	8/16/96	4:05 pm
7490 B			6.0	7.4	8/17/96	9:30 am
7490 B					8/18/96	10:15 am
					8/19/96	2:00 pm

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>60</u>	<u>84</u>
	100%	<u>180</u>	<u>208</u>
Sample #2	Control	<u>60</u>	<u>96</u>
	100%	<u>168</u>	<u>272</u>
Sample #3	Control	<u> </u>	<u> </u>
	100%	<u> </u>	<u> </u>

100311

AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT

Job #: 96-294 (u)

Organism: C. dubia

Dose	Live Count									Dose	Live Count								
	0	1	2	3	4	5	6	7	8		0	1	2	3	4	5	6	7	
6.25 A	✓	/	✓	✓	✓ 5	✓ 5	12			6.25 A	✓	✓	/	✓	✓ 5	✓ 8	11		
B	/	/	✓	/	✓ 4	✓ 9	8			B	/	/	/	/	✓ 4	✓	8		
C	/	/	✓	/	✓ 3	✓ 9	8			C	/	/	/	/	✓ 4	✓	9		
D	/	/	/	✓	✓ 5	✓ 7	11			D	/	✓	/	/	✓ 5	✓ 7	14		
E	/	/	/	✓	✓ 5	✓ 7				E	/	/	/	/	✓ 6	✓ 7	11		
F	✓	✓	/	3	✓	✓ 7	13			F	/	✓	/	/	✓ 5	✓ 8	8		
G	/	/	/	✓	✓ 5	✓ 7	4			G	/	/	/	/	✓ 4	✓ 8	11		
H	✓	✓	✓	✓	✓	✓ 4	8			H	✓	✓	/	/	✓ 6	✓ 8	12		
I	/	/	/	✓	✓ 6	✓ 7	9			I	/	/	/	✓	✓ 6	✓ 10	11		
J	✓	✓	✓	✓	✓ 6	✓ 3				J	✓	/	/	M					
6.25 A	✓	/	/	/	✓ 4	✓ 9	13			6.25 A	/	/	/	/	✓ 3	✓ 7	17		
B	/	/	✓	/	✓ 6	✓ 7	12			B	/	/	/	/	✓ 5	✓ 8	10		
C	/	/	/	/	✓ 5	✓ 8	12			C	/	/	/	/	✓ 5	✓ 10	10		
D	✓	/	/	/	✓ 5	✓ 7	10			D	/	/	/	/	✓ 4	✓ 7	10		
E	/	/	✓	/	✓ 5	✓ 6	10			E	/	/	/	/	✓ 7	✓ 7	12		
F	/	/	✓	/	✓ 5	✓ 6	13			F	/	✓	/	/	✓ 1	✓ 8	13		
G	/	/	✓	/	✓ 6	✓ 9	6			G	/	/	/	/	✓ 5	✓ 10	13		
H	/	/	/	/	✓ 5	✓ 9	11			H	/	✓	/	/	✓ 6	✓ 8	8		
I	/	/	/	/	✓ 5	✓ 10	11			I	/	✓	/	/	✓ 5	✓ 8	14		
J	/	/	✓	✓	✓ 5	✓ 10	10			J	/	/	/	/	✓ 6	✓ 10	12		
Init.	EL	EL	EL	EL	EL	EL	EL			Init.	EL	EL	EL	EL	EL	EL	EL		
Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19			Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19		

✓ = Test organism alive
x = Test organism dead
M = Lost or missing

0 = Number of live young
(-0) = Number of dead young
y = Male

10.0312

**AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT**

Job #: 96-294 (u)

Organism: C. dubia

Dose	Live Count									Dose	Live Count								
	0	1	2	3	4	5	6	7	8		0	1	2	3	4	5	6	7	
5 ⁹ A	✓	✓	✓	✓	✓	✓	✓			A									
B	✓	✓	✓	✓	✓	✓	✓			B									
C	✓	✓	✓	✓	✓	✓	✓			C									
D	✓	✓	✓	✓	✓	✓	✓			D									
E	✓	✓	✓	✓	✓	✓	✓			E									
F	✓	✓	✓	✓	✓	✓	✓			F									
G	✓	✓	✓	✓	✓	✓	✓			G									
H	✓	✓	✓	✓	✓	✓	✓			H									
I	✓	✓	✓	✓	✓	✓	✓			I									
J	✓	✓	✓	✓	✓	✓	✓			J									
10 ⁰ A	✓	✓	✓	✓	✓	✓	✓			A									
B	✓	✓	✓	✓	✓	✓	✓			B									
C	✓	✓	✓	✓	✓	✓	✓			C									
D	✓	✓	✓	✓	✓	✓	✓			D									
E	✓	✓	✓	✓	✓	✓	✓			E									
F	✓	✓	✓	✓	✓	✓	✓			F									
G	✓	✓	✓	✓	✓	✓	✓			G									
H	✓	✓	✓	✓	✓	✓	✓			H									
I	✓	✓	✓	✓	✓	✓	✓			I									
J	✓	✓	✓	✓	✓	✓	✓			J									
Init.	5L	5L	5L	2L	15	15	5L			Init.									
Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19			Date									

✓ = Test organism alive
x = Test organism dead
M = Lost or missing

0 = Number of live young
(-0) = Number of dead young
y = Male

10.0313

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
12.5	9	0	9
TOTAL	19	0	19

CRITICAL FISHER'S VALUE (10,9,10) ($p=0.05$) IS 5. b VALUE IS 9.
 Since b is greater than 5 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10

10.0314

TOTAL	20	0	20
-------	----	---	----

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

NUMBER	NUMBER	SIG
--------	--------	-----

10.0315

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	5.25	10	0	
2	12.5	9	0	
3	25	10	0	
4	50	10	0	
5	100	10	0	

10.0316

20
9/1

Chemsol 96-294 untreated C. dubia Reproduction
File: 294ucdr Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	3.953	14.278	22.538	14.278	3.953
OBSERVED	7	10	20	22	0

Calculated Chi-Square goodness of fit test statistic = 12.0455
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Chemsol 96-294 untreated C. dubia Reproduction
File: 294ucdr Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 17.16

Bartlett's test using average degrees of freedom
Calculated B2 statistic = 16.86
Based on average replicate size of 8.83

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.
Data FAIL B2 homogeneity test at 0.01 level. Try another transformation.

TITLE: Chemsol 96-294 untreated C. dubia Reproduction

FILE: 294ucdr

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	22.0000	22.0000
1	Control	2	21.0000	21.0000
1	Control	3	20.0000	20.0000
1	Control	4	23.0000	23.0000
1	Control	5	12.0000	12.0000
1	Control	6	23.0000	23.0000
1	Control	7	16.0000	16.0000
1	Control	8	12.0000	12.0000
1	Control	9	22.0000	22.0000
1	Control	10	9.0000	9.0000
2	6.25	1	26.0000	26.0000
2	6.25	2	25.0000	25.0000
2	6.25	3	25.0000	25.0000
2	6.25	4	22.0000	22.0000
2	6.25	5	21.0000	21.0000
2	6.25	6	24.0000	24.0000
2	6.25	7	21.0000	21.0000
2	6.25	8	25.0000	25.0000
2	6.25	9	26.0000	26.0000
2	6.25	10	25.0000	25.0000
3	12.5	1	24.0000	24.0000
3	12.5	2	12.0000	12.0000
3	12.5	3	13.0000	13.0000
3	12.5	4	26.0000	26.0000
3	12.5	5	24.0000	24.0000
3	12.5	6	21.0000	21.0000
3	12.5	7	23.0000	23.0000
3	12.5	8	26.0000	26.0000
3	12.5	9	27.0000	27.0000
4	25	1	24.0000	24.0000
4	25	2	23.0000	23.0000
4	25	3	25.0000	25.0000
4	25	4	21.0000	21.0000
4	25	5	26.0000	26.0000
4	25	6	22.0000	22.0000
4	25	7	28.0000	28.0000
4	25	8	22.0000	22.0000
4	25	9	27.0000	27.0000
4	25	10	28.0000	28.0000
5	50	1	29.0000	29.0000
5	50	2	22.0000	22.0000
5	50	3	10.0000	10.0000
5	50	4	24.0000	24.0000
5	50	5	24.0000	24.0000
5	50	6	26.0000	26.0000
5	50	7	29.0000	29.0000
5	50	8	25.0000	25.0000
5	50	9	14.0000	14.0000
5	50	10	15.0000	15.0000
6	100	1	33.0000	33.0000

100318

20/1/8

6	100	2	28.0000	28.0000
6	100	3	29.0000	29.0000
6	100	4	28.0000	28.0000
6	100	5	30.0000	30.0000
6	100	6	29.0000	29.0000
6	100	7	30.0000	30.0000
6	100	8	10.0000	10.0000
6	100	9	30.0000	30.0000
6	100	10	23.0000	23.0000

Chemsol 96-294 untreated C. dubia Reproduction
 File: 294ucdr Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	10	9.000	23.000	18.000
2	6.25	10	21.000	26.000	24.000
3	12.5	9	12.000	27.000	21.778
4	25	10	21.000	28.000	24.600
5	50	10	10.000	29.000	21.800
6	100	10	10.000	33.000	27.000

Chemsol 96-294 untreated C. dubia Reproduction
 File: 294ucdr Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	28.000	5.292	1.673	29.40
2	6.25	3.778	1.944	0.615	8.10
3	12.5	30.944	5.563	1.854	25.54
4	25	6.711	2.591	0.819	10.53
5	50	43.067	6.563	2.075	30.10
6	100	42.000	6.481	2.049	24.00

Chemsol 96-294 untreated C. dubia Reproduction
File: 294ucdr Transform: NO TRANSFORMATION

WILCOXON'S RANK SUM TEST W/ BONFERRONI ADJUSTMENT - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	REPS	SIG
1	Control	18.000				
2	6.25	24.000	143.00	74.00	10	
3	12.5	21.778	114.50	61.00	9	
4	25	24.600	143.50	74.00	10	
5	50	21.800	129.00	74.00	10	
6	100	27.000	145.00	74.00	10	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

10.0321

7/1/96

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	22	26	24	24	29	33
Response 2	21	25	12	23	22	28
Response 3	20	25	13	25	10	29
Response 4	23	22	26	21	24	28
Response 5	12	21	24	26	24	30
Response 6	23	24	21	22	26	29
Response 7	16	21	23	28	29	30
Response 8	12	25	26	22	25	10
Response 9	22	26	27	27	14	30
Response 10	9	25		28	15	23

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Effluent

Test Start Date: 8/13/96 Test Ending Date: 8/19/96

Test Species: C. dubia

Test Duration: 6

DATA FILE: 294ucdr.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	18.000	5.292	22.881
2	10	6.250	24.000	1.944	22.881
3	9	12.500	21.778	5.563	22.881
4	10	25.000	24.600	2.591	22.881
5	10	50.000	21.800	6.563	22.881
6	10	100.000	27.000	6.481	22.881

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

10.0322

9/02

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/13/96	11:01:50	ECU	24.75	321.00	0.2	7.32	7.76
8/13/96	11:01:57	6.25	24.91	339.00	0.2	7.54	7.73
8/13/96	11:02:05	12.5	24.95	350.00	0.2	7.34	7.71
8/13/96	11:02:13	DS	24.96	373.00	0.2	7.68	7.66
8/13/96	11:02:21	5C	24.82	414.00	0.2	7.32	7.56
8/13/96	11:02:33	100	24.82	510.00	0.2	7.14	7.37

EC 8/14/96

10.0323

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	9:46:31 <i>ear</i>	24.41	335.00	0.2	7.62	8.42
8/14/96	9:46:37 <i>6.25</i>	24.65	347.00	0.2	7.65	8.25
8/14/96	9:46:42 <i>1.25</i>	24.62	358.00	0.2	7.90	8.19
8/14/96	9:46:49 <i>25</i>	24.64	380.00	0.2	7.88	8.10
8/14/96	9:46:56 <i>50</i>	24.68	428.00	0.2	7.90	7.97
8/14/96	9:47:04 <i>100</i>	24.72	523.00	0.2	7.67	7.81

CC 8/14/96

100324

YSI 6000 Time Series Report

Page :

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:03:59	24.09	326.00	0.2	8.75	8.46
8/15/96	10:04:11	24.88	345.00	0.2	7.70	7.90
8/15/96	10:04:18	24.91	360.00	0.2	7.71	7.86
8/15/96	10:04:24	24.95	393.00	0.2	7.70	7.79
8/15/96	10:04:30	25.00	465.00	0.2	7.68	7.68
8/15/96	10:04:37	25.08	608.00	0.3	7.65	7.52

10.0325

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	10:24:06	6.25	24.06	332.00	0.2	8.70	8.60
8/16/96	10:24:14	6.25	24.63	348.00	0.2	8.02	8.38
8/16/96	10:24:20	6.25	24.69	364.00	0.2	8.07	8.27
8/16/96	10:24:27	6.25	24.72	396.00	0.2	8.05	8.16
8/16/96	10:24:33	6.25	24.71	464.00	0.2	8.00	8.04
8/16/96	10:24:39	6.25	24.66	600.00	0.3	7.92	7.87

SL 8166196

10.0326

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	8:09:27	24.44	304.00	0.2	7.51	8.19
8/17/96	8:09:43	24.52	322.00	0.2	7.72	8.08
8/17/96	8:09:52	24.56	338.00	0.2	7.72	8.02
8/17/96	8:10:02	24.59	366.00	0.2	7.74	7.95
8/17/96	8:10:09	24.59	429.00	0.2	7.76	7.85
8/17/96	8:10:21	24.62	552.00	0.3	7.73	7.64

10.0327

YSI 6000 Time Series Report

Page

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:23:38	24.71	314.00	0.2	8.03	8.01
8/18/96	9:23:50	24.81	339.00	0.2	7.91	7.97
8/18/96	9:24:00	24.92	344.00	0.2	8.06	7.90
8/18/96	9:24:09	25.05	381.00	0.2	8.10	7.84
8/18/96	9:24:19	25.15	440.00	0.2	8.00	7.76
8/18/96	9:24:32	25.36	568.00	0.3	7.93	7.55

10.0328

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	15:06:38	<i>Em</i>	24.22	332.00	0.2	7.22	7.81
8/14/96	15:07:10	<i>6.25</i>	25.16	378.00	0.2	7.39	7.77
8/14/96	15:07:31	<i>12.5</i>	24.96	389.00	0.2	7.64	7.77
8/14/96	15:07:50	<i>25</i>	24.79	412.00	0.2	7.78	7.78
8/14/96	15:08:28	<i>50</i>	24.80	461.00	0.2	7.54	7.90
8/14/96	15:08:52	<i>100</i>	24.94	561.00	0.3	7.51	8.03

518/15/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	16:36:36	607	25.67	413.00	0.2	7.52	8.37
8/15/96	16:36:44	625	25.71	388.00	0.2	7.48	8.20
8/15/96	16:36:50	125	25.68	390.00	0.2	7.46	8.15
8/15/96	16:36:55	25	25.67	413.00	0.2	7.47	8.11
8/15/96	16:37:02	50	25.66	456.00	0.2	7.46	8.10
8/15/96	16:37:09	100	25.65	550.00	0.3	7.46	8.15

EL 8/15/96

10.0330

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	17:46:09	24.91	402.00	0.2	7.89	7.98
8/16/96	17:46:15	25.56	418.00	0.2	7.80	7.95
8/16/96	17:46:21	25.65	431.00	0.2	7.79	7.94
8/16/96	17:46:26	25.75	463.00	0.2	7.78	7.92
8/16/96	17:46:32	25.73	532.00	0.2	7.81	7.93
8/16/96	17:46:38	25.70	674.00	0.3	7.82	7.96

10.0331

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Conc uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	9:38:30	25.86	295.00	0.1	7.50	7.92
8/17/96	9:39:01	25.97	236.00	0.1	7.26	7.81
8/17/96	9:39:16	25.83	218.00	0.1	7.23	7.81
8/17/96	9:39:28	25.62	315.00	0.2	7.16	7.75
8/17/96	9:39:40	25.68	353.00	0.2	7.44	7.75
8/17/96	9:39:52	25.69	429.00	0.2	7.14	7.85

10.0332

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	10:59:58	24.05	344.00	0.2	7.53	7.96
8/18/96	11:00:08	24.14	366.00	0.2	7.51	7.92
8/18/96	11:00:17	24.26	382.00	0.2	7.51	7.92
8/18/96	11:00:26	24.31	407.00	0.2	7.53	7.93
8/18/96	11:00:36	24.31	484.00	0.2	7.55	7.94
8/18/96	11:00:45	24.30	608.00	0.3	7.57	8.02

10.0333

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	16:29:16	25.13	368.00	0.2	7.64	8.01
8/19/96	16:29:27	25.11	393.00	0.2	7.54	7.99
8/19/96	16:29:38	25.07	401.00	0.2	7.53	7.98
8/19/96	16:29:46	25.11	418.00	0.2	7.50	7.98
8/19/96	16:29:55	25.04	481.00	0.2	7.50	7.99
8/19/96	16:30:05	25.09	613.00	0.3	7.50	8.03

10.0334

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 8/13/96

TEST JOB#: 96-294

CLIENT: Beijer Assoc

TEST LOCATION: IN-LAB [✓]

FIELD []

TEST SPECIES: C. dubia

TOTAL NUMBER ORGANISMS TRANSFERRED: 120+

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: CD

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: General Culture
2. RECEIVING LOG #: VOID
3. CULTURE LOG #: 96-0478
4. AGE/SIZE INFORMATION: 624hrs UD 8/12/96 2330-07.

B. HOLDING [] CULTURE [✓] WATER PARAMETERS

1. TEMPERATURE: 23.0°C
2. SALINITY: VOID
3. WATER SOURCE: 100% Recirc

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT
DATE: 8/13/96
TIME: 0600 hrs
BY: EL
2. LIVESTOCK RECEIVING
DATE: 8/13/96
TIME: 0900 hrs
BY: ES
3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EL

REMARKS: _____

3

CHRONIC BIOMONITORING REPORT

Chemsol Plant
Pimephales promelas
(Treated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

10.0336



NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.

ACUTE TOXICITY ID./CERTIFICATION #: 10309

DATE OF LAST SRT TEST: 7/22/96

NOEC/IC₂₅: 0.5 ppt KCl / 0.56CONTROL CHART MEAN(NOEC/IC₂₅): 0.35/0.60

UPPER CONTROL LIMIT: 0.70/0.89

LOWER CONTROL LIMIT: 0.18/0.33

TEST START DATE: 8/13/96

TEST END DATE: 8/20/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

<input checked="" type="checkbox"/>	Fathead minnow, (CN/FM)	NOEC: 100%	LOEC: ≥100%	IC ₂₅ : ≥100%
	Method 1000.0 (<i>Pimephales promelas</i>) 7 day Larval Survival and Growth Test)			
<input type="checkbox"/>	Cladoceran, (CN/CD)	NOEC	LOEC	
	Method 1002.0 (<i>Ceriodaphnia dubia</i>) 3 brood Survival and Reproduction Test)			
<input type="checkbox"/>	Sheepshead minnow, (CN/SM)	NOEC	LOEC	
	Method 1005.0 (<i>Cyprinodon variegatus</i>) 7 day Larval Survival and Growth Test)			
<input type="checkbox"/>	Inland Silverside, (CN/IS)	NOEC	LOEC	
	Method 1006.0 (<i>Menidia beryllina</i>) 7 day Larval Survival and Growth Test)			
<input type="checkbox"/>	Mysid, (CN/MS)	NOEC	LOEC	
	Method 1007.0 (<i>Mysidopsis bahia</i>) 7 day Survival, Growth and Fecundity Test)			
<input type="checkbox"/>	Alga, (CN/SC)	NOEC	LOEC	
	Method 1003.0 (<i>Selenastrum capricornutum</i>) Growth Test)			
<input type="checkbox"/>	Macroalga, (CN/CP)	NOEC	LOEC	
	Method 1009.0 (<i>Champia parvula</i>) Sexual Reproduction Test)			

CONTROL MORTALITY (Percent): 2.5%

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes ☒ No ☐

CERTIFICATION:

Accuracy of report certified by:

York Terrell
York Terrell
Project Manager

9/5/96
Date

TEST DESIGN

1

10.0337



Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 4
 Number of Test Organisms per Replicate: 10
 Number of Test Organisms per Test Concentration: 40

Test Chamber Size: 1000 mL

Exposure Volume: 500 mL

Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite ☒ Other ☐ Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	7.9	7.9	8/13-14	3:30 pm
8/13 - 8:00 am	8/14 - 8:00 am	7.5	8.0	8/15-16	3:00 pm
8/15 - 8:00 am	8/16 - 8:00 am	8.3	8.2	8/17-19	8:15 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

**SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW,
INLAND SILVERSIDE AND MYSID TESTS**

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	97.5	0.457	
6.25	97.5	0.560	
12.5	100.0	0.515	
25	100.0	0.618	
50	92.5	0.605	
100	92.5	0.678	

Organism source: x Cultured Stock Commercial Supplier

Name of Supplier:

Hatch Dates: 8/12/96

Organism Age (days/hrs.): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? X Yes No

Did the temperature in the test chambers vary by more than 1°C each day?
 x Yes No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
 Yes No

*How long after test termination were the mysids examined for eggs and sexes?

* Applies to mysid test only

A

P

P

E

N

D

I

X

100340

AQUA SURVEY, INC.
CHRONIC DEPARTMENT

GENERAL INFORMATION

Job #: 96-294 (T) Test Exposure Volume: 500 ml
 Client: BGR (treated) Dilution Water: 100% Recirc
 Organism: P. Prom Age: <24 hr
 Test Temperature: 25°C ± 1°
 Stocked By: ES Initial Count Checked By: ES
 Test Start Date: 5/13/96 Time: 3:30 PM
 Test End Date: 8/20/96 Time: 11:45 AM
 Water Bath #: 1

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
7432A			7.9	7.9	8/13/96	3:30 PM
7432A			—	—	8/14/96	1:30 PM
7455A			7.5	8.0	8/15/96	3:00 PM
7455A			—	—	8/16/96	3:15
7490A			8.3	8.2	8/17/96	8:15 AM
7490A					8/18/96	9:30 AM
7490A					8/18/96	9 AM

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>60</u>	<u>84</u>
	100%	<u>180</u>	<u>188</u> ^{ES 8/13/96}
Sample #2	Control	<u>60</u>	<u>96</u>
	100%	<u>170</u>	<u>228</u>
Sample #3	Control	<u>80</u>	<u>112</u>
	100%	<u>176</u>	<u>392</u>

100341

AQUA SURVEY, INC.
CHRONIC STUDIES DEPARTMENT
LIVE COUNT

Job #:

96-294
Indefinite

Organisms:

P. promelas

Date	TEST DAY								Additional Information/Comments
	0	1	2	3	4	5	6	7	
4/13	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	9	9	9	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
6-25	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	9	
D	10	10	10	10	10	10	10	10	
1-25	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
2-25	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
5-20	10	10	10	10	10	10	10	9	
B	10	10	9	9	9	9	9	9	
C	10	10	10	9	9	9	9	9	
D	10	10	10	10	10	10	10	10	
1-20	10	10	9	9	8	8	7	8	
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	9	
D	10	10	10	10	10	10	10	10	
A									
B									
C									
D									
Initial	E3	E3	EL	YT	E3	E3	Y3	EL	
Date	8/13	8/14	8/15	8/15	8/16	8/17	8/18	8/20	

Superscript numbers in live count box = number of dead bodies

8/16 8/17 8/18 8/19
EL 8/20

100342

Chemsol 96-294 Treated P. promelas Survival
File: 294tpps Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.125

W = 0.915

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Chemsol 96-294 Treated P. promelas Survival
File: 294tpps Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance
Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: Chemsol 96-294 Treated P. promelas Survival

FILE: 294tpps

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	1.0000	1.4120
1	Control	2	0.9000	1.2490
1	Control	3	1.0000	1.4120
1	Control	4	1.0000	1.4120
2	6.25	1	1.0000	1.4120
2	6.25	2	1.0000	1.4120
2	6.25	3	0.9000	1.2490
2	6.25	4	1.0000	1.4120
3	12.5	1	1.0000	1.4120
3	12.5	2	1.0000	1.4120
3	12.5	3	1.0000	1.4120
3	12.5	4	1.0000	1.4120
4	25	1	1.0000	1.4120
4	25	2	1.0000	1.4120
4	25	3	1.0000	1.4120
4	25	4	1.0000	1.4120
5	50	1	0.9000	1.2490
5	50	2	0.9000	1.2490
5	50	3	0.9000	1.2490
5	50	4	1.0000	1.4120
6	100	1	0.8000	1.1071
6	100	2	1.0000	1.4120
6	100	3	0.9000	1.2490
6	100	4	1.0000	1.4120

100344

UG
41

Chemsol 96-294 Treated P. promelas Survival
 File: 294tpps Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	1.249	1.412	1.371
2	6.25	4	1.249	1.412	1.371
3	12.5	4	1.412	1.412	1.412
4	25	4	1.412	1.412	1.412
5	50	4	1.249	1.412	1.290
6	100	4	1.107	1.412	1.295

Chemsol 96-294 Treated P. promelas Survival
 File: 294tpps Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.007	0.081	0.041	5.94
2	6.25	0.007	0.081	0.041	5.94
3	12.5	0.000	0.000	0.000	0.00
4	25	0.000	0.000	0.000	0.00
5	50	0.007	0.081	0.041	6.32
6	100	0.022	0.147	0.073	11.35

100345

50
QC
9.

Chemsol 96-294 Treated P. promelas Survival

File: 294tpps

Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Control	1.371				
2	6.25	1.371	18.00	10.00	4.00	
3	12.5	1.412	20.00	10.00	4.00	
4	25	1.412	20.00	10.00	4.00	
5	50	1.290	14.00	10.00	4.00	
6	100	1.295	15.50	10.00	4.00	

Critical values use $k = 5$, are 1 tailed, and $\alpha = 0.05$

10.0346

JGC
9/3/9

AQUA SURVEY, INC.
DRY WEIGHT DETERMINATION

Job #: 96-294

Client: BGR

Organism: P. promelas

Facility: houston

Age at Start Test: 24/2m

Balance: PART

Conc/rep	Pan #	A	B	B-A	C	(B-A)/C x 100
A Control	1	1.3281	1.3272	0.0041		0.41
B	2	1.3166	1.3210	0.0044		0.44
C	3	1.3085	1.3134	0.0049		0.49
D	4	1.3070	1.3119	0.0049		0.49
A 6.25	5	1.3245	1.3303	0.0058		0.58
B	6	1.3104	1.3152	0.0048		0.48
C	7	1.3144	1.3202	0.0058		0.58
D	8	1.3157	1.3197	0.0040		0.40
A 12.5	9	1.3056	1.3104	0.0048		0.48
B	10	1.3207	1.3251	0.0044		0.44
C	11	1.3180	1.3240	0.0060		0.60
D	12	1.3250	1.3304	0.0054		0.54
A 25	13	1.2965	1.3020	0.0055		0.55
B	14	1.3030	1.3096	0.0066		0.66
C	15	1.2975	1.3039	0.0064		0.64
D	16	1.3025	1.3087	0.0062		0.62
A 50	17	1.3219	1.3281	0.0062		0.62
B	18	1.3206	1.3260	0.0054		0.54
C	19	1.3214	1.3278	0.0064		0.64
D	20	1.3283	1.3345	0.0062		0.62
A 100	21	1.3294	1.3358	0.0064		0.64
B	22	1.3139	1.3212	0.0073		0.73
C	23	1.3171	1.3246	0.0075		0.75
D	24	1.3160	1.3219	0.0059		0.59
A						
B						
C						
D						
INITIALS		EL	EL	RL		MI
DATE		8/20	8/23	8/30		8/30

A = Weight pan empty (g)

B = Dry weight of fish + pan (g)

C = Initial number of fish

(B-A)/Cx1000 = Mean Dry weight of fish (mg)

Task	Date	Time	Initials
Organisms to petri	8/20	11 ⁴⁵ PM	EC
Petri placed in Oven	8/20	1 ²⁰ PM	EC
Petri placed in incubator	8/21	1 ²⁰ PM	EC
Temperature			

Temperature

[illegible]

10.0347

Chemsol 96-294 Treated P. promelas Dry Weight
File: 294tppdw Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.058

W = 0.930

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Chemsol 96-294 Treated P. promelas Dry Weight
File: 294tppdw Transform: NO TRANSFORMATION


Bartlett's test for homogeneity of variance
Calculated B1 statistic = 1.78

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

100348



TITLE: Chemsol 96-294 Treated P. promelas Dry Weight

FILE: 294tppdw

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.4100	0.4100
1	Control	2	0.4400	0.4400
1	Control	3	0.4900	0.4900
1	Control	4	0.4900	0.4900
2	6.25	1	0.5800	0.5800
2	6.25	2	0.4800	0.4800
2	6.25	3	0.5800	0.5800
2	6.25	4	0.6000	0.6000
3	12.5	1	0.4800	0.4800
3	12.5	2	0.4400	0.4400
3	12.5	3	0.6000	0.6000
3	12.5	4	0.5400	0.5400
4	25	1	0.5500	0.5500
4	25	2	0.6600	0.6600
4	25	3	0.6400	0.6400
4	25	4	0.6200	0.6200
5	50	1	0.6200	0.6200
5	50	2	0.5400	0.5400
5	50	3	0.6400	0.6400
5	50	4	0.6200	0.6200
6	100	1	0.6400	0.6400
6	100	2	0.7300	0.7300
6	100	3	0.7500	0.7500
6	100	4	0.5900	0.5900

10.0349

J

Chemsol 96-294 Treated P. promelas Dry Weight
File: 294tppdw Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	0.410	0.490	0.457
2	6.25	4	0.480	0.600	0.560
3	12.5	4	0.440	0.600	0.515
4	25	4	0.550	0.660	0.618
5	50	4	0.540	0.640	0.605
6	100	4	0.590	0.750	0.678

Chemsol 96-294 Treated P. promelas Dry Weight
File: 294tppdw Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.002	0.039	0.020	8.63
2	6.25	0.003	0.054	0.027	9.67
3	12.5	0.005	0.070	0.035	13.59
4	25	0.002	0.048	0.024	7.75
5	50	0.002	0.044	0.022	7.33
6	100	0.006	0.075	0.038	11.14

10.0350

200

Chemsol 96-294 Treated P. promelas Dry Weight
File: 294tppdw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.123	0.025	7.642
Within (Error)	18	0.058	0.003	
Total	23	0.181		

Critical F value = 2.77 (0.05,5,18)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

100351

Chemsol 96-294 Treated P. promelas Dry Weight
 File: 294tppdw Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.457	0.457		
2	6.25	0.560	0.560	-2.553	
3	12.5	0.515	0.515	-1.432	
4	25	0.618	0.618	-3.985	
5	50	0.605	0.605	-3.674	
6	100	0.678	0.678	-5.480	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

Chemsol 96-294 Treated P. promelas Dry Weight
 File: 294tppdw Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	6.25	4	0.097	21.1	-0.103
3	12.5	4	0.097	21.1	-0.058
4	25	4	0.097	21.1	-0.160
5	50	4	0.097	21.1	-0.148
6	100	4	0.097	21.1	-0.220

10.0352

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.41	.58	.48	.55	.62	.64
Response 2	.44	.48	.44	.66	.54	.73
Response 3	.49	.58	.60	.64	.64	.75
Response 4	.49	.60	.54	.62	.62	.59

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Effluent

Test Start Date: 8/13/96 Test Ending Date: 8/20/96

Test Species: P. promelas

Test Duration: 7 day

DATA FILE: 294tppdw.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.457	0.039	0.572
2	4	6.250	0.560	0.054	0.572
3	4	12.500	0.515	0.070	0.572
4	4	25.000	0.618	0.048	0.572
5	4	50.000	0.605	0.044	0.572
6	4	100.000	0.678	0.075	0.572

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

100353

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/13/96	11:03:15	ear	24.79	320.00	0.2	7.41	7.73
8/13/96	11:03:22	6.25	25.11	339.00	0.2	7.40	7.76
8/13/96	11:03:28	12.5	25.18	349.00	0.2	7.38	7.77
8/13/96	11:03:35	25	25.23	373.00	0.2	7.35	7.79
8/13/96	11:03:41	50	25.23	413.00	0.2	7.38	7.82
8/13/96	11:03:50	100	25.22	501.00	0.2	7.36	7.82

8/14/96

100354

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	9:47:45 <i>ear</i>	24.56	336.00	0.2	7.96	8.22
8/14/96	9:47:51 <i>6.25</i>	24.63	346.00	0.2	7.83	8.17
8/14/96	9:47:56 <i>12.5</i>	24.62	356.00	0.2	7.81	8.12
8/14/96	9:48:01 <i>25</i>	24.65	379.00	0.2	7.81	8.09
8/14/96	9:48:08 <i>50</i>	24.78	421.00	0.2	7.85	8.06
8/14/96	9:48:16 <i>100</i>	24.78	514.00	0.2	7.85	8.03

EL 8/14/96

10.0355

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:05:11	24.83	329.00	0.2	7.66	7.96
8/15/96	10:05:17	24.94	346.00	0.2	7.67	7.92
8/15/96	10:05:23	24.93	360.00	0.2	7.69	7.90
8/15/96	10:05:29	24.95	390.00	0.2	7.71	7.89
8/15/96	10:05:36	25.03	457.00	0.2	7.74	7.90
8/15/96	10:05:45	25.04	592.00	0.3	7.76	7.92

10.0356

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	10:25:32	coll	24.16	334.00	0.2	8.13	8.30
8/16/96	10:25:39	6.25	24.65	347.00	0.2	7.76	8.14
8/16/96	10:25:45	12.5	24.66	363.00	0.2	8.04	8.12
8/16/96	10:25:51	25	24.68	392.00	0.2	8.05	8.10
8/16/96	10:25:56	50	24.68	458.00	0.2	8.08	8.09
8/16/96	10:26:05	100	24.58	587.00	0.3	8.00	8.10

EC 8/16/96

100357

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:08:38	24.31	305.00	0.2	8.33	8.14
8/18/96	9:08:52	24.33	333.00	0.2	7.59	8.11
8/18/96	9:09:01	24.29	357.00	0.2	7.74	8.10
8/18/96	9:09:46	24.75	376.00	0.2	7.91	8.17
8/18/96	9:09:53	24.74	443.00	0.2	7.91	8.15
8/18/96	9:10:03	24.83	573.00	0.3	7.91	8.14

10.0358

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:41:57	24.48	327.00	0.2	7.34	8.32
8/19/96	9:42:02	25.31	345.00	0.2	7.54	8.10
8/19/96	9:42:09	25.61	366.00	0.2	7.46	8.04
8/19/96	9:42:13	25.82	388.00	0.2	7.43	8.01
8/19/96	9:42:20	25.91	452.00	0.2	7.65	8.00
8/19/96	9:42:26	26.00	589.00	0.3	7.84	7.97

10.0359

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	10:16:08	<i>Em</i>	24.47	351.00	0.2	7.62	8.40
8/14/96	10:16:15	<i>6.25</i>	25.13	360.00	0.2	6.84	8.09
8/14/96	10:16:21	<i>12.5</i>	25.23	375.00	0.2	6.77	7.97
8/14/96	10:16:27	<i>25</i>	25.24	398.00	0.2	6.71	7.90
8/14/96	10:16:32	<i>50</i>	25.29	438.00	0.2	6.81	7.84
8/14/96	10:16:38	<i>100</i>	25.20	530.00	0.2	6.80	7.83

EC 8/14/96

10.0360

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:20:43	6.26	24.06	340.00	0.2	6.80	8.04
8/15/96	10:20:48	6.25	24.33	355.00	0.2	6.79	7.88
8/15/96	10:20:57	1.5	24.57	365.00	0.2	6.39	7.75
8/15/96	10:21:04	2.5	24.72	382.00	0.2	6.32	7.68
8/15/96	10:21:10	5.0	24.81	427.00	0.2	6.37	7.63
8/15/96	10:21:18	1.60	24.88	519.00	0.2	6.22	7.66

EL 8/15/96

10.0361

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	11:54:06	24.00	343.00	0.2	5.27	8.13
8/16/96	11:54:16	24.12	354.00	0.2	5.04	7.91
8/16/96	11:54:21	24.19	371.00	0.2	5.00	7.85
8/16/96	11:54:27	24.30	400.00	0.2	4.87	7.77
8/16/96	11:54:33	24.38	467.00	0.2	4.68	7.69
8/16/96	11:54:39	24.46	602.00	0.3	4.75	7.65

8/16/96

100362

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	7:46:33	24.54	318.00	0.2	7.35	7.39
8/17/96	7:46:40	25.15	347.00	0.2	6.08	7.27
8/17/96	7:46:48	25.40	364.00	0.2	6.03	7.21
8/17/96	7:46:56	25.58	393.00	0.2	5.68	7.15
8/17/96	7:47:10	25.74	460.00	0.2	5.47	7.14
8/17/96	7:47:17	25.76	589.00	0.3	5.38	7.19

10.0363

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	8:51:20	24.16	326.00	0.2	7.29	7.21
8/18/96	8:51:27	24.42	346.00	0.2	6.54	7.12
8/18/96	8:51:33	24.58	359.00	0.2	6.72	7.11
8/18/96	8:51:40	24.76	385.00	0.2	6.63	7.10
8/18/96	8:51:47	24.84	453.00	0.2	6.42	7.10
8/18/96	8:51:53	24.88	581.00	0.3	6.47	7.15

10.0364

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:15:24	25.31	378.00	0.2	6.63	7.93
8/19/96	9:15:55	26.95	389.00	0.2	6.92	7.84
8/19/96	9:16:14	24.92	391.00	0.2	7.50	8.11
8/19/96	9:16:35	24.99	407.00	0.2	7.22	8.10
8/19/96	9:17:25	24.32	467.00	0.2	7.27	8.08
8/19/96	9:17:45	24.43	602.00	0.3	6.81	7.97
8/19/96	9:18:42	25.43	345.00	0.2	5.44	7.89

100365

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/20/96	9:00:33	24.50	352.00	0.2	6.00	7.83
8/20/96	9:00:45	24.57	365.00	0.2	5.92	7.72
8/20/96	9:00:57	24.63	387.00	0.2	5.74	7.66
8/20/96	9:01:09	24.65	408.00	0.2	5.80	7.62
8/20/96	9:01:24	24.70	475.00	0.2	5.83	7.63
8/20/96	9:01:37	24.75	616.00	0.3	6.07	7.70

100366

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 8-13-96

TEST JOB#: 96-294

CLIENT: BA

TEST LOCATION: IN-LAB [☒]

FIELD [☐]

TEST SPECIES: P. promelas

TOTAL NUMBER ORGANISMS TRANSFERRED: 4805

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: EL

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: Hatch unit

2. RECEIVING LOG #: void

3. CULTURE LOG #: 96-0475

4. AGE/SIZE INFORMATION: 424 hours HD 8-12-96

B. HOLDING [☐] CULTURE [☒] WATER PARAMETERS

1. TEMPERATURE: 25.0°C

2. SALINITY: void

3. WATER SOURCE: 100% Recirc

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 8-13-96
TIME: 1409 hrs
BY: EL

2. LIVESTOCK RECEIVING DATE: 8-13-96
TIME: 1409 hrs
BY: (EL) RO JS

3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EL

REMARKS: (EL) MR 2/2

10.0367

(4)

CHRONIC BIOMONITORING REPORT

Chemsol Plant
Ceriodaphnia dubia
(Treated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

10.0363



NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.ACUTE TOXICITY ID./CERTIFICATION #: 10309

DATE OF LAST SRT TEST: 7/15/96

NOEC/IC₂₅: 0.25 ppt KCl / 0.34CONTROL CHART MEAN(NOEC/IC₂₅): 0.225/0.31UPPER CONTROL LIMIT: NOEC/IC₂₅ 0.45/0.46

LOWER CONTROL LIMIT: 0.11/0.16

TEST START DATE: 8/13/96TEST END DATE: 8/19/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

- | | | | |
|---|---|--|------------------|
| - | Fathead minnow, (CN/FM) | NOEC | LOEC |
| | Method 1000.0 (<u>Pimephales promelas</u>) 7 day Larval Survival and Growth Test) | | |
| X | Cladoceran, (CN/CD) | NOEC/IC ₂₅ : <u>12.5%/26.7%</u> | LOEC: <u>25%</u> |
| | Method 1002.0 (<u>Ceriodaphnia dubia</u>) 3 brood Survival and Reproduction Test) | | |
| - | Sheepshead minnow, (CN/SM) | NOEC | LOEC |
| | Method 1005.0 (<u>Cyprinodon variegatus</u>) 7 day Larval Survival and Growth Test) | | |
| - | Inland Silverside, (CN/IS) | NOEC | LOEC |
| | Method 1006.0 (<u>Menidia beryllina</u>) 7 day Larval Survival and Growth Test) | | |
| - | Mysid, (CN/MS) | NOEC | LOEC |
| | Method 1007.0 (<u>Mysidopsis bahia</u>) 7 day Survival, Growth and Fecundity Test) | | |
| - | Alga, (CN/SC) | NOEC | LOEC |
| | Method 1003.0 (<u>Selenastrum capricornutum</u>) Growth Test) | | |
| - | Macroalga, (CN/CP) | NOEC | LOEC |
| | Method 1009.0 (<u>Champia parvula</u>) Sexual Reproduction Test) | | |

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes XNo —

CERTIFICATION:

Accuracy of report certified by:

York Terrell
 York Terrell
 Project Manager

9/5/96
 Date

TEST DESIGN

Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 10
 Number of Test Organisms per Replicate: 1
 Number of Test Organisms per Test Concentration: 10
 Test Chamber Size: 30 mL Exposure Volume: 15 mL
 Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite ☒ Other ☐ Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	7.9	7.9	8/13-14	11:40 am
8/13 - 8:00 am	8/14 - 8:00 am	7.5	8.0	8/15-16	11:30 am
8/15 - 8:00 am	8/16 - 8:00 am	8.3	8.2	8/17-18	8:30 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

**SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST**

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	23.7	70
6.25	100	21.6	100
12.5	100	20.4	70
25	100	19.1	70
50	0	0	0
100	0	0	0

Organism source: X Cultured Stock Commercial Supplier

Name of Supplier:

Organism Age at test start (hrs.): <24 hrs.

Test organisms all released with an 8 hour period? X Yes No

Neonates obtained from (check one):

 Mass cultures

 X individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood? X Yes No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippia

Percent Effluent	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrations influence the determination of the NOEC/IC25?

 Yes

 X No

A

P

P

E

N

D

I

X

10.0372

**AQUA SURVEY, INC.
CHRONIC DEPARTMENT**

GENERAL INFORMATION

Job #: 96-294 (1) Test Exposure Volume: 15ml
 Client: BGR (treated) Dilution Water: 100% Recirc
 Organism: C. dubia Age: < 24 Hr
 Test Temperature: 25°C ± 1°C
 Stocked By: SC Initial Count Checked By: SC
 Test Start Date: 8/13/96 Time: 11:40 am
 Test End Date: 8/19/96 Time: 2:10 pm
 Water Bath #: 1

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
7432A			7.9	7.9	8/13/96	11:40 am
7432A			—	—	8/14/96	1:30 pm
7433A			7.5	8.0	8/15/96	11:30 am
			—	—	8/16/96	4:30 pm
7490A			8.3	8.2	8/17/96	8:30 am
7490A					8/18/96	9:45 am
					8/19/96	2:10 pm

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>60</u>	<u>84</u>
	100%	<u>180</u>	<u>244</u>
Sample #2	Control	<u>60</u>	<u>96</u>
	100%	<u>170</u>	<u>228</u>
Sample #3	Control	<u> </u>	<u> </u>
	100%	<u> </u>	<u> </u>

10.0373

AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT

Job #: 96-244 (+)

Organism: C. dubia

Dose	Live Count									Dose	Live Count								
	0	1	2	3	4	5	6	7	8		0	1	2	3	4	5	6	7	
1A	✓	✓	/	✓	✓5	✓9	✓10			1A	✓	✓	✓	✓	✓5	✓10	✓9		
B	✓	✓	/	/	✓	✓8	✓14			B	✓	✓	/	/	✓4	⑨9	✓6		
C	/	/	/	/	✓5	✓3	✓8			C	/	✓	/	✓	✓4	⑨9	✓10		
D	/	/	/	/	✓6	✓8	✓12			D	/	/	/	/	✓5	⑨14	✓10		
E	/	/	/	/	✓	✓12	✓18			E	/	/	/	/	✓5	✓9	✓12		
F	/	/	/	/	✓6	✓8	✓12			F	/	/	/	/	✓5	✓9	✓11		
G	/	/	/	/	✓5	✓9	✓10			G	/	/	/	/	✓6	✓8	✓8		
H	/	/	/	/	✓6	✓5	✓12			H	/	/	/	✓	✓5	✓9	✓10		
I	/	/	/	/	✓	✓5	✓12			I	/	/	/	/	✓6	⑨9	✓8		
J	/	/	/	/	✓4	✓6	✓14			J	/	/	/	✓	✓3	⑨10	✓10		
2A	/	/	/	/	✓4	✓10	✓12			2A	/	/	/	/	✓4	✓10	✓8		
B	/	/	/	/	✓4	✓9	✓12			B	/	/	/	✓	✓5	✓9	✓8		
C	/	/	/	/	✓5	✓8	✓8			C	/	/	/	/	✓6	✓9	✓		
D	/	/	/	/	✓4	✓8	✓6			D	/	/	/	✓	✓5	✓10	✓		
E	/	✓	/	/	✓6	✓8	✓8			E	✓	/	/	/	✓5	✓8	✓10		
F	/	/	/	/	✓4	✓6	✓10			F	/	/	/	/	✓5	✓9	✓		
G	/	/	/	/	✓4	✓8	✓10			G	/	/	/	✓	✓4	✓8	✓10		
H	/	/	/	/	✓5	✓6	✓8			H	✓	/	/	✓	✓	✓9	✓8		
I	/	/	/	/	✓4	✓9	✓12			I	/	/	/	✓	✓6	✓8	✓7		
J	/	✓	/	/	✓6	✓7	✓8			J	✓	/	/	/	✓6	✓7	✓6		
Init.	EC	EC	EC	EC	ES	RT	AN			Init.	EC	EC	EC	EC	ES	RT	AN		
Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19			Date	8/13	8/14	8/15	8/16	8/17	8/18	8/19		

✓ = Test organism alive
x = Test organism dead
M = Lost or missing

0 = Number of live young
(-0) = Number of dead young
y = Male

10.0374

① ✓
② ✓
③ ✓
④ ✓ 12
⑤ ✓

→ RT SL

AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT

Job #: _____

Organism: C. dubia

Dose	Live Count										Dose	Live Count									
	0	1	2	3	4	5	6	7	8	0		1	2	3	4	5	6	7	8		
50 A	✓	X									A										
B	✓	X									B										
C	✓	X									C										
D	✓	X									D										
E	✓	X									E										
F	✓	X									F										
G	✓	X									G										
H	✓	X									H										
I	✓	X									I										
J	✓	X									J										
100 A	✓	X									A										
B	✓	X									B										
C	✓	X									C										
D	✓	X									D										
E	✓	X									E										
F	✓	X									F										
G	✓	X									G										
H	✓	X									H										
I	✓	X									I										
J	✓	X									J										
Init.	CL	CL									Init.										
Date	2/13	8/14									Date										

✓ = Test organism alive
 x = Test organism dead
 M = Lost or missing

0 = Number of live young
 (-0) = Number of dead young
 y = Male

10.0375

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.25, 12.5, 25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50, 100	0	10	10
TOTAL	10	10	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 0.
 Since b is less than or equal to 6 there is a significant difference
 between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
1	CONTROL	10	0	
2	6.25, 12.5, 25	10	0	
	50, 100	10	10	*

Chemsol 96-294 Treated C. dubia Reproduction
File: 294tcdR Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.680	9.680	15.280	9.680	2.680
OBSERVED	3	8	13	15	1

Calculated Chi-Square goodness of fit test statistic = 4.6469
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Chemsol 96-294 Treated C. dubia Reproduction
File: 294tcdR Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.25

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)
Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

10.0377

OK
9/3/96

TITLE: Chemsol 96-294 Treated C. dubia Reproduction

FILE: 294tcd

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	24.0000	24.0000
1	Control	2	22.0000	22.0000
1	Control	3	21.0000	21.0000
1	Control	4	26.0000	26.0000
1	Control	5	30.0000	30.0000
1	Control	6	26.0000	26.0000
1	Control	7	24.0000	24.0000
1	Control	8	23.0000	23.0000
1	Control	9	17.0000	17.0000
1	Control	10	24.0000	24.0000
2	6.25	1	26.0000	26.0000
2	6.25	2	24.0000	24.0000
2	6.25	3	21.0000	21.0000
2	6.25	4	16.0000	16.0000
2	6.25	5	22.0000	22.0000
2	6.25	6	20.0000	20.0000
2	6.25	7	22.0000	22.0000
2	6.25	8	19.0000	19.0000
2	6.25	9	25.0000	25.0000
2	6.25	10	21.0000	21.0000
3	12.5	1	24.0000	24.0000
3	12.5	2	10.0000	10.0000
3	12.5	3	14.0000	14.0000
3	12.5	4	21.0000	21.0000
3	12.5	5	25.0000	25.0000
3	12.5	6	25.0000	25.0000
3	12.5	7	22.0000	22.0000
3	12.5	8	24.0000	24.0000
3	12.5	9	26.0000	26.0000
3	12.5	10	13.0000	13.0000
4	25	1	22.0000	22.0000
4	25	2	21.0000	21.0000
4	25	3	15.0000	15.0000
4	25	4	15.0000	15.0000
4	25	5	23.0000	23.0000
4	25	6	14.0000	14.0000
4	25	7	22.0000	22.0000
4	25	8	22.0000	22.0000
4	25	9	18.0000	18.0000
4	25	10	19.0000	19.0000

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c

Chemsol 96-294 Treated C. dubia Reproduction
File: 294tcdR Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	10	17.000	30.000	23.700
2	6.25	10	16.000	26.000	21.600
3	12.5	10	10.000	26.000	20.400
4	25	10	14.000	23.000	19.100

Chemsol 96-294 Treated C. dubia Reproduction
File: 294tcdR Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	11.789	3.433	1.086	14.49
2	6.25	8.711	2.951	0.933	13.66
3	12.5	34.044	5.835	1.845	28.60
4	25	11.656	3.414	1.080	17.87

Chemsol 96-294 Treated C. dubia Reproduction
File: 294tcdR Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	114.600	38.200	2.308
Within (Error)	36	595.800	16.550	
Total	39	710.400		

Critical F value = 2.92 (0.05,3,30)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

10.0380

15

Chemsol 96-294 Treated C. dubia Reproduction
 File: 294tcdR Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	23.700	23.700		
2	6.25	21.600	21.600	1.154	
3	12.5	20.400	20.400	1.814	
4	25	19.100	19.100	2.528	*

Dunnett table value = 2.15 (1 Tailed Value, P=0.05, df=30,3)

Chemsol 96-294 Treated C. dubia Reproduction
 File: 294tcdR Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	10			
2	6.25	10	3.912	16.5	2.100
3	12.5	10	3.912	16.5	3.300
4	25	10	3.912	16.5	4.600

10.0381

67

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	24	26	24	22	0	0
Response 2	22	24	10	21	0	0
Response 3	21	21	14	15	0	0
Response 4	26	16	21	15	0	0
Response 5	30	22	25	23	0	0
Response 6	26	20	25	14	0	0
Response 7	24	22	22	22	0	0
Response 8	23	19	24	22	0	0
Response 9	17	25	26	18	0	0
Response 10	24	21	13	19	0	0

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Effluent

Test Start Date: 8/13/96 Test Ending Date: 8/19/96

Test Species: C. dubia

Test Duration: 6 day

DATA FILE: 294tcd.r.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	23.700	3.433	23.700
2	10	6.250	21.600	2.951	21.600
3	10	12.500	20.400	5.835	20.400
4	10	25.000	19.100	3.414	19.100
5	10	50.000	0.000	0.000	0.000
6	10	100.000	0.000	0.000	0.000

The Linear Interpolation Estimate: 26.7343 Entered P Value: 25

Number of Resamplings: 1000

The Bootstrap Estimates Mean: 25.7205 Standard Deviation: 3.6508

Original Confidence Limits: Lower: 11.7647 Upper: 29.2079

Resampling time in Seconds: 1.43 Random_Seed: 511093648

10.0382

26.7343
9/13/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/13/96	11:03:15	ear	24.79	320.00	0.2	7.41	7.73
8/13/96	11:03:22	6.25	25.11	339.00	0.2	7.40	7.76
8/13/96	11:03:28	12.5	25.18	349.00	0.2	7.38	7.77
8/13/96	11:03:35	25	25.23	373.00	0.2	7.35	7.79
8/13/96	11:03:41	50	25.23	413.00	0.2	7.38	7.82
8/13/96	11:03:50	100	25.22	501.00	0.2	7.36	7.82

EC 8/14/96

YSI 6000 Time Series Report

Page

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	9:47:45 <i>2an</i>	24.56	336.00	0.2	7.96	8.22
8/14/96	9:47:51 <i>6.25</i>	24.63	346.00	0.2	7.83	8.17
8/14/96	9:47:56 <i>12.5</i>	24.62	356.00	0.2	7.81	8.12
8/14/96	9:48:01 <i>25</i>	24.65	379.00	0.2	7.81	8.09
8/14/96	9:48:08 <i>50</i>	24.78	421.00	0.2	7.85	8.06
8/14/96	9:48:16 <i>100</i>	24.78	514.00	0.2	7.85	8.03

EL 8/14/96

10.0384

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:05:11	24.83	329.00	0.2	7.66	7.96
8/15/96	10:05:17	24.94	346.00	0.2	7.67	7.92
8/15/96	10:05:23	24.93	360.00	0.2	7.69	7.90
8/15/96	10:05:29	24.95	390.00	0.2	7.71	7.89
8/15/96	10:05:36	25.03	457.00	0.2	7.74	7.90
8/15/96	10:05:45	25.04	592.00	0.3	7.76	7.92

10.0385

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	10:25:32	Cal	24.16	334.00	0.2	8.13	8.30
8/16/96	10:25:39	6.25	24.65	347.00	0.2	7.76	8.14
8/16/96	10:25:45	12.5	24.66	363.00	0.2	8.04	8.12
8/16/96	10:25:51	25	24.68	392.00	0.2	8.05	8.10
8/16/96	10:25:56	50	24.68	458.00	0.2	8.08	8.09
8/16/96	10:26:05	100	24.58	587.00	0.3	8.00	8.10

SL 8/16/96

10.0386

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:08:38	24.31	305.00	0.2	8.33	8.14
8/18/96	9:08:52	24.33	333.00	0.2	7.59	8.11
8/18/96	9:09:01	24.29	357.00	0.2	7.74	8.10
8/18/96	9:09:46	24.75	376.00	0.2	7.91	8.17
8/18/96	9:09:53	24.74	443.00	0.2	7.91	8.15
8/18/96	9:10:03	24.83	573.00	0.3	7.91	8.14

10.0387

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:41:57	24.48	327.00	0.2	7.34	8.32
8/19/96	9:42:02	25.31	345.00	0.2	7.54	8.10
8/19/96	9:42:09	25.61	366.00	0.2	7.46	8.04
8/19/96	9:42:13	25.82	388.00	0.2	7.43	8.01
8/19/96	9:42:20	25.91	452.00	0.2	7.65	8.00
8/19/96	9:42:26	26.00	589.00	0.3	7.84	7.97

10.0388

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/14/96	15:16:04	EL	24.25	369.00	0.2	8.01	7.87
8/14/96	15:16:19	61.5	25.11	381.00	0.2	7.71	7.85
8/14/96	15:16:33	12.5	24.69	391.00	0.2	7.83	7.85
8/14/96	15:16:49	25	24.58	417.00	0.2	7.89	7.85
8/14/96	15:17:04	50	24.54	459.00	0.2	7.91	7.91
8/14/96	15:17:25	100	24.63	547.00	0.3	7.93	8.02

EL 8/15/96

10.0389

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/15/96	16:35:47	<i>ESU</i>	25.66	397.00	0.2	7.53	8.27
8/15/96	16:35:53	<i>6.25</i>	25.62	381.00	0.2	7.10	8.16
8/15/96	16:35:58	<i>1.25</i>	25.62	386.00	0.2	7.48	8.12
8/15/96	16:36:04	<i>25</i>	25.61	412.00	0.2	7.37	8.09

SC 8/15/96

10.0390

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/16/96	17:45:11	24.65	383.00	0.2	7.79	7.76
8/16/96	17:45:17	25.30	398.00	0.2	7.72	7.79
8/16/96	17:45:24	25.48	419.00	0.2	7.72	7.83
8/16/96	17:45:30	25.54	451.00	0.2	7.72	7.84

10.0391

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	9:27:21	25.06	212.00	0.1	6.64	7.71
8/17/96	9:27:53	25.35	284.00	0.1	7.63	7.78
8/17/96	9:28:08	25.95	229.00	0.1	7.38	7.75
8/17/96	9:28:21	25.22	368.00	0.2	7.67	7.76

100392

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	10:57:29	24.10	334.00	0.2	7.41	8.03
8/18/96	10:57:43	24.27	371.00	0.2	7.38	7.95
8/18/96	10:57:51	24.33	380.00	0.2	7.40	7.94
8/18/96	10:58:02	24.32	409.00	0.2	7.46	7.94

10.0392 A

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	17:04:00	24.47	382.00	0.2	7.20	8.29
8/19/96	17:04:10	25.03	378.00	0.2	7.15	8.18
8/19/96	17:04:17	24.45	404.00	0.2	7.25	8.14
8/19/96	17:04:24	24.20	420.00	0.2	7.31	8.11

100393

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 8/13/96
TEST JOB#: 96-244 CLIENT: Bojler Assoc.
TEST LOCATION: IN-LAB [☒] FIELD [☐]
TEST SPECIES: C. dubia
TOTAL NUMBER ORGANISMS TRANSFERRED: 120+
AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: CD

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: General Culture
2. RECEIVING LOG #: VOID
3. CULTURE LOG #: 96-0478
4. AGE/SIZE INFORMATION: 624 hrs ☒ 8/12/96 2330-073

B. HOLDING [☐] CULTURE [☒] WATER PARAMETERS

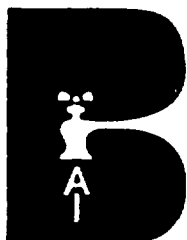
1. TEMPERATURE: 23.0°C
2. SALINITY: VOID
3. WATER SOURCE: 100% Recirc

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 8/13/96
TIME: 0900 hrs
BY: EL
2. LIVESTOCK RECEIVING DATE: 8/13/96
TIME: 0900 hrs
BY: ES
3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EL

REMARKS: _____

10.0394



Bigler Associates, Inc.

57-59 Grove St.
P.O. Box 261
Ridgefield Park, NJ 07660

de maximo, Inc.

DEC 26 1996

Phone: 1 (800) 396-0712
(201) 296-0712
FAX: (201) 296-0729

LETTER OF TRANSMITTAL

Attention: Bill Patten Date: 12/23/96
Company: de maximo
Project: Chromat
From: Ron Alexander Via: US MAIL
Subject: Chrom Toxicity Test

The attached is submitted:

☐ At your request ☐ For your action ☐ For your files
☐ For your approval ☒ For your review ☐ FYI

Comments: Enclosed are 2 copies of
the Chrom toxicity test, that was
conducted last month.

Results are excellent - no toxic effect
for either organism -

Ron

SECOND
CHRONIC TOX
TEST

Groundwater Remediation • Wastewater • Industrial Wastewater
Wastewater Collection Systems • Water

100395

2A

CHRONIC BIOMONITORING REPORT

Chemsol Plant

Pimephales promelas

(Final)

BIEGLER ASSOCIATES

PO BOX 261

RIDGEFIELD PARK, NJ 07660

December 20, 1996

JOB #96-424

10.0396



NJPDES BIOMONITORING REPORT FORM CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.

ACUTE TOXICITY ID./CERTIFICATION #: 10309

DATE OF LAST SRT TEST: 11/6/96

NOEC/IC₂₅: 0.5 ppt KCl/0.61CONTROL CHART MEAN(NOEC/IC₂₅): 0.35/0.60

UPPER CONTROL LIMIT: 0.70/0.89

LOWER CONTROL LIMIT: 0.18/0.33

TEST START DATE: 11/19/96

TEST END DATE: 11/26/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

<input checked="" type="checkbox"/>	Fathead minnow, (CN/FM) Method 1000.0 (<i>Pimephales promelas</i>) 7 day Larval Survival and Growth Test)	NOEC: 100%	LOEC: ≥100%	IC ₂₅ : ≥100%
-	Cladoceran, (CN/CD) Method 1002.0 (<i>Ceriodaphnia dubia</i>) 3 brood Survival and Reproduction Test)	NOEC	LOEC	
-	Sheepshead minnow, (CN/SM) Method 1005.0 (<i>Cyprinodon variegatus</i>) 7 day Larval Survival and Growth Test)	NOEC	LOEC	
-	Inland Silverside, (CN/IS) Method 1006.0 (<i>Menidia beryllina</i>) 7 day Larval Survival and Growth Test)	NOEC	LOEC	
-	Mysid, (CN/MS) Method 1007.0 (<i>Mysidopsis bahia</i>) 7 day Survival, Growth and Fecundity Test)	NOEC	LOEC	
-	Alga, (CN/SC) Method 1003.0 (<i>Selenastrum capricornutum</i>) Growth Test)	NOEC	LOEC	
-	Macroalga, (CN/CP) Method 1009.0 (<i>Champia parvula</i>) Sexual Reproduction Test)	NOEC	LOEC	

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes ☒No ☐

CERTIFICATION:

Accuracy of report certified by:

Tom Dolce

Tom Dolce
Supervising Biologist12/20/96
Date

TEST DESIGN

Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 4
 Number of Test Organisms per Replicate: 10
 Number of Test Organisms per Test Concentration: 40
 Test Chamber Size: 1000 mL
 Explain any deviations from the specified testing methodology:

Exposure Volume: 500 mL

EFFLUENT SAMPLING

Plant Sampling Location: Final effluent hose

Effluent Type: Final

Sample Type: 24 hour Composite ☒ Other ☐ Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
11/17 - 9:00 am	11/18 - 9:00 am	7.5	7.9	11/19-20	11:15 am
11/19 - 9:00 am	11/20 - 9:00 am	5.6	7.3	11/21-22	1:15 pm
11/21 - 9:00 am	11/22 - 9:00 am	8.1	7.4	11/23-25	11:40 am

Maximum holding time of any effluent sample 72 hrs.Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:



**SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW,
INLAND SILVERSIDE AND MYSID TESTS**

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	100.0	0.378	
6.25	95.0	0.378	
12.5	95.0	0.375	
25	100.0	0.468	
50	97.5	0.488	
100	90.0	0.420	

Organism source: ☒ Cultured Stock ☐ Commercial Supplier

Name of Supplier:

Hatch Dates: 11/18/96;1650

Organism Age (days/hrs.): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? ☒ Yes ☐ No

Did the temperature in the test chambers vary by more than 1°C each day?
☐ Yes ☒ No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
☐ Yes ☐ No

*How long after test termination were the mysids examined for eggs and sexes? ☐

* Applies to mysid test only

A

P

P

E

N

D

I

X

10.0400

**AQUA SURVEY, INC.
CHRONIC DEPARTMENT**

GENERAL INFORMATION

Job #: 96-424 Test Exposure Volume: 500 ml
 Client: BGA Dilution Water: 100% Recm
 Organism: P. Prom. Age: <24 hr.
 Test Temperature: 25.2 ± 1°C
 Stocked By: EC Initial Count Checked By: EC
 Test Start Date: 11/19/96 Time: 11:15 am
 Test End Date: 11/26/96 Time: 11:45 am
 Water Bath #: 3

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8381			7.5	7.7	11/18/96	11:15 am
					11/20/96	1:50 pm
8396			5.6	7.3	11/21/96	1:13 pm
					11/22/96	11:40 am
8416			5.1	7.4	11/23/96	11:40 am
					11/24/96	11:45 am
					11/25/96	11:45 am

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>52</u>	<u>88</u>
	100%	<u>151</u>	<u>216</u>
Sample #2	Control	<u>56</u>	<u>85</u>
	100%	<u>140</u>	<u>232</u>
Sample #3	Control	<u>56</u>	<u>88</u>
	100%	<u>144</u>	<u>216</u>

10.0401

AQUA SURVEY, INC.
CHRONIC STUDIES DEPARTMENT
LIVE COUNT

Job #: 96-424

Organisms: P. promelas

Date	TEST DAY								Additional Information/Comments
	0	1	2	3	4	5	6	7	
6-11 A	10	10	10	10	10	10	10	10	
B	10	10	10	10	10	10	310	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
6-24 A	10	10	9 9	9	9	9	9	9	10 10 EL 11/24/86
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	9	9	
D	10	10	10	10	10	10	10	10	
1-15 A	10	10	10	10	10	10	100	100	Stung lab/fish may die 11/25/86
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	9	9	③ These escape
2-5 A	10	10	10	10	10	10	10	10	10-12 LARGE exons of arteries. The water was cloudy & smelled bad & the fish were sluggish
B	10	10	10	10	10	10	10	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
5-10 A	10	10	10	10	10	9	9	9	
B	10	10	10	10	10	10	29	10	
C	10	10	10	10	10	10	10	10	
D	10	10	10	10	10	10	10	10	
1-18 A	10	10	10	10	10	22	8	8	
B	10	10	10	10	10	10	9	9	
C	10	10	10	10	10	9	9	9	
D	10	10	10	10	10	10	10	10	
A									
B									
C									
D									
Initial	EL	10	AL	10	10	10	EL	10	
Date	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	

Superscript numbers in live count box = number of dead bodies

10.0402

AQUA SURVEY, INC.
DRY WEIGHT DETERMINATION

Job #: 96-424

Client: BGA

Organism: *P. promelas*

Facility: _____

Age at Start Test: <24H

Balance: 54RT

Conc/rep	Pan #	A	B	B-A	C	(B-A)/C*1000
A Control	1	1.2497	1.2540	0.0043	10	0.43
B	2	1.2942	1.2980	0.0038	10	0.38
C	3	1.2883	1.2913	0.0030	10	0.30
D	4	1.2975	1.3015	0.0040	10	0.40
A 6.25	5	1.2678	1.2708	0.0030	10	0.30
B	6	1.2663	1.2702	0.0039	10	0.39
C	7	1.2802	1.2840	0.0038	10	0.38
D	8	1.2707	1.2751	0.0044	10	0.44
A 15.5	9	1.2539	1.2579	0.0035	10	0.35
B	10	1.2619	1.2664	0.0045	10	0.45
C	11	1.2760	1.2787	0.0037	10	0.37
D	12	1.2811	1.2844	0.0033	10	0.33
A 25	13	1.2904	1.2948	0.0044	10	0.44
B	14	1.2549	1.2600	0.0051	10	0.51
C	15	1.2684	1.2730	0.0046	10	0.46
D	16	1.2685	1.2731	0.0046	10	0.46
A 50	17	1.2500	1.2551	0.0051	10	0.51
B	18	1.2551	1.2598	0.0047	10	0.47
C	19	1.2582	1.2633	0.0051	10	0.51
D	20	1.2493	1.2537	0.0046	10	0.46
A 100	21	1.2459	1.2445	0.0036	10	0.36
B	22	1.2730	1.2768	0.0038	10	0.38
C	23	1.2741	1.2786	0.0045	10	0.45
D	24	1.2696	1.2780	0.0049	10	0.49
A						
B						
C						
D						
INITIALS	CL	DA	DA	JN		JN
DATE	11/25	11/25	11/27	12/20		12/20

Task	Date	Time	Initials
Organisms to pass	11/26	1:30 pm	DA
Pass placed in Oven	11/26	2:00 pm	DA
Pass placed in desiccator	11/27	8:30 pm	DA
Temperature	100°C		

[illegible]

A = Weight pan empty (g)

B = Dry weight of fish + pan (g)

C = Initial number of fish

A/C₁₀₀₀ = Mean Dry weight of fish (mg)

10.0403

96-424 P. promelas survival 11/19/96

File: 96424.pps Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.120

L = 0.938

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

96-424 P. promelas survival 11/19/96

File: 96424.pps Transform: ARC SINE(SQUARE ROOT(Y))

Martley's test for homogeneity of variance

Martlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: 96-424 P. promelas survival 11/19/96

FILE: 96424.pls

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	1.0000	1.4120
1	control	2	1.0000	1.4120
1	control	3	1.0000	1.4120
1	control	4	1.0000	1.4120
2	6.25	1	0.9000	1.2490
2	6.25	2	1.0000	1.4120
2	6.25	3	0.9000	1.2490
2	6.25	4	1.0000	1.4120
3	12.5	1	0.9000	1.2490
3	12.5	2	1.0000	1.4120
3	12.5	3	1.0000	1.4120
3	12.5	4	0.9000	1.2490
4	25	1	1.0000	1.4120
4	25	2	1.0000	1.4120
4	25	3	1.0000	1.4120
4	25	4	1.0000	1.4120
5	50	1	0.9000	1.2490
5	50	2	1.0000	1.4120
5	50	3	1.0000	1.4120
5	50	4	1.0000	1.4120
6	100	1	0.8000	1.1071
6	100	2	0.9000	1.2490
6	100	3	0.9000	1.2490
6	100	4	1.0000	1.4120

96-424 P. promelas survival 11/19/96

File: 96424.pps

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	4	1.412	1.412	1.412
2	6.25	4	1.249	1.412	1.331
3	12.5	4	1.249	1.412	1.331
4	25	4	1.412	1.412	1.412
5	50	4	1.249	1.412	1.371
6	100	4	1.107	1.412	1.254

96-424 P. promelas survival 11/19/96

File: 96424.pps

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.000	0.000	0.000	0.00
2	6.25	0.009	0.094	0.047	7.07
3	12.5	0.009	0.094	0.047	7.07
4	25	0.000	0.000	0.000	0.00
5	50	0.007	0.081	0.041	5.94
6	100	0.016	0.125	0.062	9.93

96-424 P. promelas survival 11/19/96

File: 96424.pps

Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST

-

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	control	1.412				
2	6.25	1.331	14.00	10.00	4.00	
3	12.5	1.331	14.00	10.00	4.00	
4	25	1.412	18.00	10.00	4.00	
5	50	1.371	16.00	10.00	4.00	
6	100	1.254	12.00	10.00	4.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

10.0407

06-424 P. promelas dry weight 11/29/96

File: p6424.pdw Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.043

W = 0.973

Critical W (P = 0.05) (n = 24) = 0.916

Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

96-424 P. promelas dry weight 11/29/96

File: p6424.pdw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 2.94

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

10.0409

TI E: 96-424 P. promelas dry weight 11/29/96

FILE: p6424.pdw

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	0.4300	0.4300
1	control	2	0.3800	0.3800
1	control	3	0.3000	0.3000
1	control	4	0.4000	0.4000
2	6.25	1	0.3000	0.3000
2	6.25	2	0.3900	0.3900
2	6.25	3	0.3800	0.3800
2	6.25	4	0.4400	0.4400
3	12.5	1	0.3500	0.3500
3	12.5	2	0.4500	0.4500
3	12.5	3	0.3700	0.3700
3	12.5	4	0.3300	0.3300
4	25	1	0.4400	0.4400
4	25	2	0.5100	0.5100
4	25	3	0.4600	0.4600
4	25	4	0.4600	0.4600
5	50	1	0.5100	0.5100
5	50	2	0.4700	0.4700
5	50	3	0.5100	0.5100
5	50	4	0.4600	0.4600
6	100	1	0.3600	0.3600
6	100	2	0.3800	0.3800
6	100	3	0.4500	0.4500
6	100	4	0.4900	0.4900

100410

96-424 P. promelas dry weight 11/29/96

file: p6424.pdw

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	4	0.300	0.430	0.378
2	6.25	4	0.300	0.440	0.378
3	12.5	4	0.330	0.450	0.375
4	25	4	0.440	0.510	0.468
5	50	4	0.460	0.510	0.488
6	100	4	0.360	0.490	0.420

96-424 P. promelas dry weight 11/29/96

file: p6424.pdw

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.003	0.056	0.028	14.73
2	6.25	0.003	0.058	0.029	15.35
3	12.5	0.003	0.053	0.026	14.03
4	25	0.001	0.030	0.015	6.39
5	50	0.001	0.026	0.013	5.39
6	100	0.004	0.061	0.030	14.42

10.0411

96-424 P. promelas dry weight 11/29/96

File: p6424.pdw

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
between	5	0.050	0.010	4.118
Within (Error)	18	0.043	0.002	
Total	23	0.093		

Critical F value = 2.77 (0.05,5,18)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

10.0412

96-424 P. promelas dry weight 11/29/96

File: p6424.pdw

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	0.378	0.378		
2	6.25	0.378	0.378	-0.000	
3	12.5	0.375	0.375	0.072	
4	25	0.468	0.468	-2.592	
5	50	0.488	0.488	-3.168	
6	100	0.420	0.420	-1.224	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

96-424 P. promelas dry weight 11/29/96

File: p6424.pdw

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	4			
	6.25	4	0.084	22.2	-0.000
	12.5	4	0.084	22.2	0.003
4	25	4	0.084	22.2	-0.090
5	50	4	0.084	22.2	-0.110
6	100	4	0.084	22.2	-0.043

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.43	.30	.35	.44	.51	.36
Response 2	.38	.39	.45	.51	.47	.38
Response 3	.30	0.38	.37	.46	.51	.45
Response 4	.40	.44	.33	.46	.46	.49

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: 96-424

Test Start Date: 11/19/96 Test Ending Date: 11/26/96

Test Species: P.promelas

Test Duration: 7 days

DATA FILE: 96424p.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.378	0.056	0.418
2	4	6.250	0.378	0.058	0.418
3	4	12.500	0.375	0.053	0.418
4	4	25.000	0.468	0.030	0.418
5	4	50.000	0.488	0.026	0.418
6	4	100.000	0.420	0.061	0.418

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH	
11/19/96	11:16:28	CON	24.37	330.00	0.2	8.22	7.49
11/19/96	11:16:35	G.25	24.84	341.00	0.2	8.09	7.56
11/19/96	11:16:42	12.5	24.89	351.00	0.2	8.08	7.58
11/19/96	11:16:50	25	24.98	369.00	0.2	8.08	7.59
11/19/96	11:16:59	50	25.03	412.00	0.2	8.08	7.58
11/19/96	11:17:05	100	25.05	495.00	0.2	8.09	7.55

A 11/19/96

100415

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/20/96	11:34:11	<i>Ear</i>	24.55	378.00	0.2	7.48	8.44
11/20/96	11:34:19	<i>6.25</i>	24.62	373.00	0.2	7.32	8.33
11/20/96	11:34:26	<i>12.5</i>	24.69	379.00	0.2	7.28	8.29
11/20/96	11:34:32	<i>25</i>	24.79	403.00	0.2	7.26	8.24
11/20/96	11:34:38	<i>50</i>	24.88	450.00	0.2	7.24	8.19
11/20/96	11:34:45	<i>100</i>	24.98	597.00	0.3	7.23	8.11

EL 11/20/96

100416

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/21/96	11:33:49	<i>6.4</i>	24.60	358.00	0.2	8.34	8.31
11/21/96	11:33:59	<i>6.45</i>	24.71	356.00	0.2	8.28	8.28
11/21/96	11:34:05	<i>12.5</i>	24.78	365.00	0.2	8.25	8.26
11/21/96	11:34:16	<i>25</i>	24.81	389.00	0.2	8.24	8.23
11/21/96	11:34:31	<i>50</i>	24.70	437.00	0.2	8.28	8.18
11/21/96	11:34:40	<i>100</i>	24.63	537.00	0.3	8.31	8.11

EC 11/21/96

10.0417

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/22/96	10:25:29	24.33	344.00	0.2	8.51	8.02
11/22/96	10:25:53	24.53	353.00	0.2	8.18	7.97
11/22/96	10:26:02	24.49	359.00	0.2	7.90	7.96
11/22/96	10:26:12	24.44	394.00	0.2	7.80	7.92
11/22/96	10:26:19	24.38	428.00	0.2	7.81	7.89
11/22/96	10:26:27	24.31	531.00	0.3	7.82	7.82

D A 11/22/96

10.0418

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/23/96	8:29:24 <i>LOW</i>	24.08	339.00	0.2	8.64	7.23
11/23/96	8:29:31 <i>6.25</i>	24.45	348.00	0.2	8.73	7.35
11/23/96	8:29:38 <i>12.5</i>	24.46	358.00	0.2	8.76	7.39
11/23/96	8:29:44 <i>25</i>	24.49	380.00	0.2	8.75	7.42
11/23/96	8:29:49 <i>50</i>	24.52	425.00	0.2	8.74	7.42
11/23/96	8:29:55 <i>100</i>	24.56	514.00	0.2	8.72	7.41

TD 11/23/96

10.0419

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/24/96	10:40:46 <i>CON</i>	24.21	313.00	0.2	8.79	7.93
11/24/96	10:41:07 <i>6.25</i>	24.31	327.00	0.2	8.74	7.98
11/24/96	10:41:12 <i>12.5</i>	24.33	341.00	0.2	8.74	7.97
11/24/96	10:41:17 <i>2.5</i>	24.36	363.00	0.2	8.72	7.96
11/24/96	10:41:23 <i>10</i>	24.44	405.00	0.2	8.70	7.96
11/24/96	10:41:29 <i>100</i>	24.57	496.00	0.2	8.68	7.94

To 11/24

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/25/96	10:57:46	24.54	343.00	0.2	8.06	7.18
11/25/96	10:58:05	24.69	357.00	0.2	8.30	7.94
11/25/96	10:58:34	24.54	355.00	0.2	8.38	7.62
11/25/96	10:58:39	24.76	386.00	0.2	8.42	7.77
11/25/96	10:59:01	24.52	414.00	0.2	8.57	7.70
11/25/96	10:59:07	24.90	528.00	0.2	8.66	7.83

SA 11/25/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/20/96	8:44:58	25.18	377.00	0.2	6.82	8.64
11/20/96	8:45:06	25.24	362.00	0.2	6.67	8.37
11/20/96	8:45:16	25.40	370.00	0.2	6.63	8.22
11/20/96	8:45:23	25.47	387.00	0.2	6.60	8.14
11/20/96	8:45:29	25.48	428.00	0.2	6.56	8.06
11/20/96	8:45:36	25.51	510.00	0.2	6.53	7.98

DA 11/20/96

10.0422

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/21/96	10:13:47	<i>Con</i>	24.33	335.00	0.2	6.10	7.31
11/21/96	10:14:34	<i>6.25</i>	24.18	354.00	0.2	5.91	7.28
11/21/96	10:14:53	<i>12.5</i>	24.57	373.00	0.2	5.68	7.44
11/21/96	10:15:07	<i>25</i>	24.72	395.00	0.2	5.40	7.52
11/21/96	10:15:17	<i>50</i>	24.84	447.00	0.2	5.19	7.56
11/21/96	10:15:28	<i>100</i>	25.01	583.00	0.3	5.02	7.72

2C 11/21/96

10.0423

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/22/96	10:30:32	Can	24.84	367.00	0.2	6.21	8.27
11/22/96	10:30:57	6.25	25.02	365.00	0.2	5.20	8.00
11/22/96	10:31:08	12.5	25.01	370.00	0.2	4.93	7.95
11/22/96	10:31:24	25	25.05	396.00	0.2	4.67	7.87
11/22/96	10:31:32	50	25.04	443.00	0.2	4.80	7.82
11/22/96	10:31:40	100	25.03	547.00	0.3	4.79	7.75

End 11/22/96

10.0424

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/23/96	8:38:17 <i>LOW</i>	24.19	351.00	0.2	5.89	8.03
11/23/96	8:38:23 <i>6.45</i>	24.33	370.00	0.2	5.51	7.96
11/23/96	8:38:28 <i>12.5</i>	24.39	377.00	0.2	5.37	7.92
11/23/96	8:38:34 <i>15</i>	24.50	409.00	0.2	5.20	7.86
11/23/96	8:38:39 <i>50</i>	24.56	452.00	0.2	5.13	7.82
11/23/96	8:38:45 <i>120</i>	24.59	545.00	0.3	5.25	7.75

11/23/96

10.0425

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/24/96	10:33:39 <i>com</i>	24.06	325.00	0.2	6.41	7.13
11/24/96	10:33:48 <i>6.25</i>	24.36	349.00	0.2	5.50	7.34
11/24/96	10:33:56 <i>12.5</i>	24.61	350.00	0.2	4.86	7.36
11/24/96	10:34:04 <i>2.5</i>	24.79	369.00	0.2	4.85	7.40
11/24/96	10:34:10 <i>50</i>	24.84	415.00	0.2	4.55	7.42
11/24/96	10:34:16 <i>100</i>	24.84	498.00	0.2	4.36	7.53

11/24

10.0426

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/25/96	11:10:13	24.04	347.00	0.2	4.17	7.07
11/25/96	11:10:54	24.11	365.00	0.2	4.22	7.23
11/25/96	11:11:04	24.30	355.00	0.2	4.27	7.30
11/25/96	11:11:11	24.36	399.00	0.2	4.44	7.36
11/25/96	11:11:19	24.39	447.00	0.2	4.62	7.42
11/25/96	11:11:29	24.44	540.00	0.3	4.93	7.68

A 11/25/96

10.0427

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 11-19-96

TEST JOB#: 96-424

CLIENT: BGL

TEST LOCATION: IN-LAB [☒]

FIELD [☐]

TEST SPECIES: P. promelas

TOTAL NUMBER ORGANISMS TRANSFERRED: 200+

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: EL

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: Hatch unit
2. RECEIVING LOG #: NA
3. CULTURE LOG #: 96-0706
4. AGE/SIZE INFORMATION: <24hr to 11-12-96 ~ 1650hr

B. HOLDING [☐] CULTURE [☒] WATER PARAMETERS

1. TEMPERATURE: 25.0 °C
2. SALINITY: VOID
3. WATER SOURCE: 100% Recycled

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 11-10-96
TIME: 1700
BY: EL
2. LIVESTOCK RECEIVING DATE: 11-19-96
TIME: 1700
BY: EL
3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EL

REMARKS: _____

100428

213

CHRONIC BIOMONITORING REPORT

Chemsol Plant
Ceriodaphnia dubia
(Final)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

December 20, 1996

JOB #96-424

10.0429



NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey, Inc.

ACUTE TOXICITY ID./CERTIFICATION #: 10309

DATE OF LAST SRT TEST: 11/5/96

NOEC/IC₂₅: 0.25*ppt KCl/0.26

*The 0.125 ppt was significantly different from the control, but was considered a trend deviation

CONTROL CHART MEAN(NOEC/IC₂₅): 0.225/0.31

UPPER CONTROL LIMIT:

NOEC/IC₂₅

0.45/0.46

LOWER CONTROL LIMIT:

0.11/0.16

TEST START DATE: 8/13/96

TEST END DATE: 8/19/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

- Fathead minnow, (CN/FM) NOEC LOEC
Method 1000.0 (*Pimephales promelas*) 7 day Larval Survival and Growth Test)
- X Cladoceran, (CN/CD) NOEC/IC₂₅: 100%/>100% LOEC: >100%
Method 1002.0 (*Ceriodaphnia dubia*) 3 brood Survival and Reproduction Test)
- Sheepshead minnow, (CN/SM) NOEC LOEC
Method 1005.0 (*Cyprinodon variegatus*) 7 day Larval Survival and Growth Test)
- Inland Silverside, (CN/IS) NOEC LOEC
Method 1006.0 (*Menidia beryllina*) 7 day Larval Survival and Growth Test)
- Mysid, (CN/MS) NOEC LOEC
Method 1007.0 (*Mysidopsis bahia*) 7 day Survival, Growth and Fecundity Test)
- Alga, (CN/SC) NOEC LOEC
Method 1003.0 (*Selenastrum capricornutum*) Growth Test)
- Macroalga, (CN/CP) NOEC LOEC
Method 1009.0 (*Champia parvula*) Sexual Reproduction Test)

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document?

Yes XNo —

CERTIFICATION:

Accuracy of report certified by:

Tom Dolce12/20/96

Tom Dolce

Date

Project Manager

TEST DESIGN

Number of Effluent Concentrations: 5
 Number of Replicates per Test Concentration: 10
 Number of Test Organisms per Replicate: 1
 Number of Test Organisms per Test Concentration: 10
 Test Chamber Size: 30 mL Exposure Volume: 15 mL
 Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location: Final effluent hose

Effluent Type: Final

Sample Type: 24 hour Composite ☒ Other ☐ Describe: ☐

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
11/17- 9:00 am	11/18 - 9:00 am	7.5	7.9	11/19-20	11:15 am
11/19 - 9:00 am	11/20 - 9:00 am	5.6	7.3	11/21-22	11:40 am
11/21 - 9:00 am	11/22/- 9:00 am	8.1	7.4	11/23-24	8:55 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample: _____

Testing Location: On-site Mobile Laboratory ☐
 On-site Commercial Laboratory ☐
 Remote Laboratory ☒

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection: _____

10.0431

**SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST**

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	14.7	70.0
6.25	90	16.4	70
12.5	100	15.5	90
25	100	15.3	100
50	100	16.7	60
100	100	15.5	60

Organism source: ☒ Cultured Stock ☐ Commercial Supplier

Name of Supplier:

Organism Age at test start (hrs.): <24 hrs. 11/18/96 ;1130

Test organisms all released with an 8 hour period? ☒ Yes ☐ No

Neonates obtained from (check one):

☐ Mass cultures

☒ individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood? ☒ Yes ☐ No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippia

Percent Effluent	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrations influence the determination of the NOEC/IC25?

☐ Yes

☒ No

100432

A

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P

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N

D

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X

**AQUA SURVEY, INC.
CHRONIC DEPARTMENT**

GENERAL INFORMATION

Job #: 96-424 Test Exposure Volume: 15ml
 Client: PGA Dilution Water: 100% Recirc
 Organism: C. dubia Age: < 24 hr.
 Test Temperature: 25.2 ± 1°C
 Stocked By: SL Initial Count Checked By: SL
 Test Start Date: 11/19/96 Time: 11:15 am
 Test End Date: 11/25/96 Time: 3:57 pm
 Water Bath #: 1

ASI #	Sample Collection		Sample Data		Use in Toxicity Test	
	Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8381			7.5	7.9	11/14/96	11:15 am
					11/20/96	9:50 am
8396			8.4	7.8	11/21	10:40 am
					11/22	9:35 am
8416			8.1	7.4	11/23/96	8:55 am
					11/24/96	11:05 am

		Alkalinity mg/L	Hardness mg/L
Sample #1	Control	<u>52</u>	<u>88</u>
	100%	<u>151</u>	<u>216</u>
Sample #2	Control	<u>56</u>	<u>88</u>
	100%	<u>140</u>	<u>232</u>
Sample #3	Control	<u>56</u>	<u>88</u>
	100%	<u>144</u>	<u>216</u>

10.0434

AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT

Job #: 96-474

Organism: C. dubia

Dose	Live Count									Dose	Live Count								
	0	1	2	3	4	5	6	7	8		0	1	2	3	4	5	6	7	8
eqm A	✓	✓	✓	✓ ³	✓ ⁷	✓	✓ ¹⁴			2.5 A	✓	✓	✓	✓ ²	✓ ⁷	✓	✓ ¹		
B	✓	✓	✓	✓ ⁴	✓ ⁶	✓	✓ ¹			B	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ¹		
C	✓	✓	✓	✓ ³	✓ ⁷	✓	✓			C	✓	✓	✓	✓ ²	✓ ⁷	✓	✓ ¹		
D	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓ ³			D	✓	✓	✓	✓ ³	✓ ⁷	✓	✓ ¹¹		
E	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓			E	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓ ³		
F	✓	✓	✓	✓ ²	✓ ⁷	✓	✓			F	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓ ⁴		
G	✓	✓	✓	✓ ⁴	✓ ⁷	✓	✓ ¹			G	✓	✓	✓	✓ ³	✓ ⁷	✓	✓ ³		
H	✓	✓	✓	✓ ³	✓ ⁷	✓	✓ ⁹			H	✓	✓	✓	✓ ³	✓ ⁸	✓	✓		
I	✓	✓	✓	✓ ²	✓ ⁷	✓	✓ ³			I	✓	✓	✓	✓ ⁴	✓ ⁷	✓	✓ ¹²		
J	✓	✓	✓	✓ ⁴	✓ ⁶	✓	✓ ³			J	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ¹¹		
6.25 A	✓	✓	✓	✓ ³	✓ ⁶	✓	✓			2.5 A	✓	✓	✓	✓ ³	✓ ⁶	✓	✓ ¹		
B	✓	✓	✓	✓ ³	✓ ⁷	✓	✓ ³			B	✓	✓	✓	✓ ³	✓ ⁹	✓	✓ ¹		
C	✓	✓	✓	✓ ⁴	✓ ⁷	✓	✓ ²			C	✓	✓	✓	✓ ²	✓ ⁹	✓	✓ ⁶		
D	✓	✓	✓	✓ ⁴	✓ ⁶	✓	✓ ¹⁶			D	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ¹³		
E	✓	✓	✓	✓ ³	✓ ⁶	✓	✓ ⁴			E	✓	✓	✓	✓ ²	✓ ⁹	✓	✓ ¹		
F	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓ ¹¹			F	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ³		
G	✓	✓	✓	✓ ²	✓ ⁹	✓	✓ ¹⁴			G	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ¹		
H	✓	✓	✓	✓ ⁴	✓ ⁷	✓	✓ ³			H	✓	✓	✓	✓ ²	✓ ⁹	✓	✓ ¹		
I	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓			I	✓	✓	✓	✓ ⁴	✓ ⁸	✓	✓ ¹		
J	✓	✓	✓	✓ ³	✓ ⁷	✓	✓			J	✓	✓	✓	✓ ³	✓ ⁸	✓	✓ ¹⁵		
Init.	eqm	50	DA	50	50	50	DA			Init.	eqm	50	DA	50	50	50	DA		
Date	11/19	11/20	11/21	11/22	11/23	11/24	11/25			Date	11/19	11/20	11/21	11/22	11/23	11/24	11/25		

✓ = Test organism alive

x = Test organism dead

M = Lost or missing

0 = Number of live young

(-0) = Number of dead young

y = Male

100435

AQUA SURVEY, INC.
CHRONIC DEPARTMENT
LIVE COUNT

Job #: 96-424

Organism: C. dubia

Dose	Live Count									Dose	Live Count								
	0	1	2	3	4	5	6	7	8		0	1	2	3	4	5	6	7	8
³⁰ A	✓	✓	✓	✓	✓	✓	✓			A									
B	✓	✓	✓	✓	✓	✓	✓			B									
C	✓	✓	✓	✓	✓	✓	✓			C									
D	✓	✓	✓	✓	✓	✓	✓			D									
E	✓	✓	✓	✓	✓	✓	✓			E									
F	✓	✓	✓	✓	✓	✓	✓			F									
G	✓	✓	✓	✓	✓	✓	✓			G									
H	✓	✓	✓	✓	✓	✓	✓			H									
I	✓	✓	✓	✓	✓	✓	✓			I									
J	✓	✓	✓	✓	✓	✓	✓			J									
¹⁰⁰ A	✓	✓	✓	✓	✓	✓	✓			A									
B	✓	✓	✓	✓	✓	✓	✓			B									
C	✓	✓	✓	✓	✓	✓	✓			C									
D	✓	✓	✓	✓	✓	✓	✓			D									
E	✓	✓	✓	✓	✓	✓	✓			E									
F	✓	✓	✓	✓	✓	✓	✓			F									
G	✓	✓	✓	✓	✓	✓	✓			G									
H	✓	✓	✓	✓	✓	✓	✓			H									
I	✓	✓	✓	✓	✓	✓	✓			I									
J	✓	✓	✓	✓	✓	✓	✓			J									
Init.		J6	DA	50	50	50	DA			Init.									
Date		11/20	11/21	11/22	11/23	11/24	11/25			Date									

✓ = Test organism alive

x = Test organism dead

M = Lost or missing

0 = Number of live young

(-0) = Number of dead young

y = Male

* Very unusual birth rate

10.0436

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.25	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 9.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
12.5, 25, 50, 100	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) ($p=0.05$) IS 6. b VALUE IS 10.
 Since b is greater than 6 there is no significant difference
 between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
	CONTROL	10	0	
	6.25	10	1	
	12.5, 25, 50, 100	10	0	

96-424 C. dubia reproduction 11/19/96
File: 424cdr Transform: NO TRANSFORMATION

Chi square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
EXPECTED	4.020	14.520	22.920	14.520	4.020
OBSERVED	0	22	20	11	7

Calculated Chi-Square goodness of fit test statistic = 11.3077
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

96-424 C. dubia reproduction 11/19/96
File: 424cdr Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 0.46

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

100438

TITLE: 96-424 C. dubia reproduction 11/19/96

424cdr

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	24.0000	24.0000
1	control	2	11.0000	11.0000
1	control	3	10.0000	10.0000
1	control	4	15.0000	15.0000
1	control	5	12.0000	12.0000
1	control	6	9.0000	9.0000
1	control	7	12.0000	12.0000
1	control	8	19.0000	19.0000
1	control	9	22.0000	22.0000
1	control	10	13.0000	13.0000
2	6.25	1	9.0000	9.0000
2	6.25	2	13.0000	13.0000
2	6.25	3	13.0000	13.0000
2	6.25	4	26.0000	26.0000
2	6.25	5	13.0000	13.0000
2	6.25	6	23.0000	23.0000
2	6.25	7	25.0000	25.0000
2	6.25	8	14.0000	14.0000
2	6.25	9	12.0000	12.0000
2	6.25	10	10.0000	10.0000
3	12.5	1	10.0000	10.0000
3	12.5	2	12.0000	12.0000
3	12.5	3	10.0000	10.0000
3	12.5	4	21.0000	21.0000
3	12.5	5	15.0000	15.0000
3	12.5	6	16.0000	16.0000
3	12.5	7	13.0000	13.0000
3	12.5	8	11.0000	11.0000
3	12.5	9	25.0000	25.0000
3	12.5	10	22.0000	22.0000
4	25	1	10.0000	10.0000
4	25	2	13.0000	13.0000
4	25	3	17.0000	17.0000
4	25	4	24.0000	24.0000
4	25	5	12.0000	12.0000
4	25	6	14.0000	14.0000
4	25	7	12.0000	12.0000
4	25	8	12.0000	12.0000
4	25	9	13.0000	13.0000
4	25	10	26.0000	26.0000
5	50	1	21.0000	21.0000
5	50	2	15.0000	15.0000
5	50	3	17.0000	17.0000
5	50	4	14.0000	14.0000
5	50	5	14.0000	14.0000
5	50	6	11.0000	11.0000
5	50	7	23.0000	23.0000
5	50	8	10.0000	10.0000
5	50	9	28.0000	28.0000
5	50	10	14.0000	14.0000

100439

6	100	1	7.0000	7.0000
6	100	2	19.0000	19.0000
6	100	3	12.0000	12.0000
6	100	4	21.0000	21.0000
6	100	5	18.0000	18.0000
6	100	6	25.0000	25.0000
6	100	7	14.0000	14.0000
6	100	8	10.0000	10.0000
6	100	9	9.0000	9.0000
6	100	10	20.0000	20.0000

96-424 C. dubia reproduction 11/19/96

File: 424cdr

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	10	9.000	24.000	14.700
2	6.25	10	9.000	26.000	15.800
3	12.5	10	10.000	25.000	15.500
4	25	10	10.000	26.000	15.300
5	50	10	10.000	28.000	16.700
6	100	10	7.000	25.000	15.500

96-424 C. dubia reproduction 11/19/96

File: 424cdr

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	27.122	5.208	1.647	35.43
2	6.25	40.178	6.339	2.004	40.12
	12.5	29.167	5.401	1.708	34.84
	25	29.567	5.438	1.719	35.54
5	50	32.011	5.658	1.789	33.88
6	100	35.389	5.949	1.881	38.38

10.0441

96-424 C. dubia reproduction 11/19/96

File: 424cdr

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	21.683	4.337	0.135
Within (Error)	54	1740.900	32.239	
Total	59	1762.583		

Critical F value = 2.45 (0.05,5,40)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

10.0442

96-424 C. dubia reproduction 11/19/96

File: 424cdr

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	14.700	14.700		
2	6.25	15.800	15.800	-0.433	
3	12.5	15.500	15.500	-0.315	
4	25	15.300	15.300	-0.236	
5	50	16.700	16.700	-0.788	
6	100	15.500	15.500	-0.315	

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

6-424 C. dubia reproduction 11/19/96

File: 424cdr

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	10			
	6.25	10	5.866	39.9	-1.100
	12.5	10	5.866	39.9	-0.800
4	25	10	5.866	39.9	-0.600
5	50	10	5.866	39.9	-2.000
6	100	10	5.866	39.9	-0.800

10.0443

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	24	9	10	10	21	7
Response 2	11	13	12	13	15	19
Response 3	10	13	10	17	17	12
Response 4	15	26	21	24	14	21
Response 5	12	13	15	12	14	18
Response 6	9	23	16	14	11	25
Response 7	12	25	13	12	23	14
Response 8	19	14	11	12	10	10
Response 9	22	12	25	13	28	9
Response 10	13	10	22	26	14	20

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: 96-424

Test Start Date: 11/19/96 Test Ending Date: 11/25/96

Test Species: C. dubia

Test Duration: 6 days

DATA FILE:

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	14.700	5.208	15.600
2	10	6.250	15.800	6.339	15.600
3	10	12.500	15.500	5.401	15.600
4	10	25.000	15.300	5.438	15.600
5	10	50.000	16.700	5.658	15.600
6	10	100.000	15.500	5.949	15.500

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

10.0444

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/19/96	11:16:28 CON	24.37	330.00	0.2	8.22	7.49
11/19/96	11:16:35 G.25	24.84	341.00	0.2	8.09	7.56
11/19/96	11:16:42 12.5	24.89	351.00	0.2	8.08	7.58
11/19/96	11:16:50 25	24.98	369.00	0.2	8.08	7.59
11/19/96	11:16:59 50	25.03	412.00	0.2	8.08	7.58
11/19/96	11:17:05 100	25.05	495.00	0.2	8.09	7.55

D A 11/19/96

10.0445

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/20/96	11:34:11	<i>Ear</i>	24.55	378.00	0.2	7.48	8.44
11/20/96	11:34:19	<i>6.25</i>	24.62	373.00	0.2	7.32	8.33
11/20/96	11:34:26	<i>12.5</i>	24.69	379.00	0.2	7.28	8.29
11/20/96	11:34:32	<i>25</i>	24.79	403.00	0.2	7.26	8.24
11/20/96	11:34:38	<i>50</i>	24.88	450.00	0.2	7.24	8.19
11/20/96	11:34:45	<i>100</i>	24.98	597.00	0.3	7.23	8.11

EL 11/20/96

100446

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/21/96	11:33:49	<i>can</i>	24.60	358.00	0.2	8.34	8.31
11/21/96	11:33:59	<i>6.25</i>	24.71	356.00	0.2	8.28	8.28
11/21/96	11:34:05	<i>12.5</i>	24.78	365.00	0.2	8.25	8.26
11/21/96	11:34:16	<i>25</i>	24.81	389.00	0.2	8.24	8.23
11/21/96	11:34:31	<i>50</i>	24.70	437.00	0.2	8.28	8.18
11/21/96	11:34:40	<i>100</i>	24.63	537.00	0.3	8.31	8.11

EL 11/21/96

10.0447

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/22/96	10:25:29	CON	24.33	344.00	0.2	8.51	8.02
11/22/96	10:25:53	G 25	24.53	353.00	0.2	8.18	7.97
11/22/96	10:26:02	12.5	24.49	359.00	0.2	7.90	7.96
11/22/96	10:26:12	25	24.44	394.00	0.2	7.80	7.92
11/22/96	10:26:19	50	24.38	428.00	0.2	7.81	7.89
11/22/96	10:26:27	100	24.31	531.00	0.3	7.82	7.82

D A 11/22/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/23/96	8:29:24 <i>CON</i>	24.08	339.00	0.2	8.64	7.23
11/23/96	8:29:31 <i>6.75</i>	24.45	348.00	0.2	8.73	7.35
11/23/96	8:29:38 <i>12.5</i>	24.46	358.00	0.2	8.76	7.39
11/23/96	8:29:44 <i>25</i>	24.49	380.00	0.2	8.75	7.42
11/23/96	8:29:49 <i>50</i>	24.52	425.00	0.2	8.74	7.42
11/23/96	8:29:55 <i>100</i>	24.56	514.00	0.2	8.72	7.41

TD 11/23/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/24/96	10:40:46 <i>CON</i>	24.21	313.00	0.2	8.79	7.93
11/24/96	10:41:07 <i>6.25</i>	24.31	327.00	0.2	8.74	7.98
11/24/96	10:41:12 <i>12.5</i>	24.33	341.00	0.2	8.74	7.97
11/24/96	10:41:17 <i>2.5</i>	24.36	363.00	0.2	8.72	7.96
11/24/96	10:41:23 <i>12</i>	24.44	405.00	0.2	8.70	7.96
11/24/96	10:41:29 <i>100</i>	24.57	496.00	0.2	8.68	7.94

70 11/24

10.0450

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/20/96	14:56:23	201	25.07	385.00	0.2	7.39	8.09
11/20/96	14:56:34	6.45	25.61	401.00	0.2	7.05	8.07
11/20/96	14:56:42	12.5	25.70	403.00	0.2	7.03	8.06
11/20/96	14:56:49	25	25.73	436.00	0.2	7.03	8.05
11/20/96	14:56:57	50	25.72	470.00	0.2	7.05	8.05
11/20/96	14:57:05	100	25.68	553.00	0.3	7.08	8.08

SL 11/20/96

10.0451

Y&I 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/21/96	13:44:44	CON	25.54	328.00	0.2	7.43	7.80
11/21/96	13:44:53	G.25	25.63	226.00	0.1	7.29	7.83
11/21/96	13:45:02	12.5	25.85	233.00	0.1	7.23	7.84
11/21/96	13:45:09	25	25.96	242.00	0.1	7.22	7.85
11/21/96	13:45:14	50	25.99	261.00	0.1	7.22	7.88
11/21/96	13:45:19	100	25.99	367.00	0.2	7.23	7.89

J A 11/21/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/22/96	10:43:17	CON	24.89	273.00	0.1	7.45	7.84
11/22/96	10:43:22	6.25	25.70	396.00	0.2	7.14	7.86
11/22/96	10:43:29	12.5	25.86	406.00	0.2	7.07	7.87
11/22/96	10:43:36	25	25.93	431.00	0.2	7.06	7.88
11/22/96	10:43:42	50	25.95	478.00	0.2	7.08	7.88
11/22/96	10:43:49	100	25.98	582.00	0.3	7.08	7.92

DA 11/22/96

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/23/96	12:21:44 CON	24.04	370.00	0.2	7.39	7.75
11/23/96	12:21:52 6.25	24.32	405.00	0.2	7.18	7.79
11/23/96	12:22:01 12.5	24.49	416.00	0.2	7.16	7.82
11/23/96	12:22:09 25	24.55	447.00	0.2	7.15	7.85
11/23/96	12:22:17 10	24.57	486.00	0.2	7.15	7.89
11/23/96	12:22:27 100	24.49	597.00	0.3	7.20	7.99

no 11/23/96

100454

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/24/96	13:00:44 <i>con</i>	24.08	346.00	0.2	7.11	7.43
11/24/96	13:00:50 <i>6.25</i>	24.40	384.00	0.2	7.05	7.47
11/24/96	13:00:56 <i>12.5</i>	24.63	396.00	0.2	7.01	7.51
11/24/96	13:01:01 <i>25</i>	24.79	415.00	0.2	7.01	7.55
11/24/96	13:01:06 <i>10</i>	24.89	454.00	0.2	7.00	7.58
11/24/96	13:01:12 <i>00</i>	24.93	538.00	0.3	7.01	7.64

TD 11/24

10.0455

YSI 6000 Time Series Report

Page 1

Date mm/dd/yy	Time hh:mm:ss		Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
11/25/96	16:39:13	CON	24.08	388.00	0.2	7.49	7.94
11/25/96	16:39:27	6.25	24.08	206.00	0.1	7.56	7.97
11/25/96	16:39:39	125	24.17	402.00	0.2	7.58	8.00
11/25/96	16:39:48	25	24.23	425.00	0.2	7.59	8.03
11/25/96	16:39:53	50	24.29	477.00	0.2	7.59	8.06
11/25/96	16:39:59	100	24.38	572.00	0.3	7.58	8.19

DA 11/25/96

100456

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 11/19/96
TEST JOB#: 96-424 CLIENT: BGR
TEST LOCATION: IN-LAB [☒] FIELD [☐]
TEST SPECIES: C. dubia
TOTAL NUMBER ORGANISMS TRANSFERRED: 60+
AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: mcp

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: General Culture
2. RECEIVING LOG #: VOID
3. CULTURE LOG #: 96-0703
4. AGE/SIZE INFORMATION: <24 hrs 4 D. 11/19 HRS 11:30-14:45

B. HOLDING [☐] CULTURE [☒] WATER PARAMETERS

1. TEMPERATURE: 24.3C
2. SALINITY: 0.0
3. WATER SOURCE: 100% Recirc

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 11/19/96
TIME: 11:00
BY: mcp

2. LIVESTOCK RECEIVING DATE: 11/19/96
TIME: 11:00
BY: EC

3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: EC

REMARKS: _____

100457

▽

de maximis, inc.

186 Center Street
Suite 290
Clinton, NJ 08809
(908) 735-9315

FILE COPY

April 9, 1997

Chief
New Jersey Superfund Branch II
Emergency and Remedial Response Division
U.S. Environmental Protection Agency
290 Broadway/19th Floor
New York, New York 10007-1866

VIA FAX AND OVERNIGHT COURIER

Attn: Mr. James Haklar

**RE: Chemsol Site - Administrative Order II CERCLA 20104
RD/RA Program For Interim Groundwater Remedy**

Dear Mr. Haklar:

Enclosed please find three copies of the Quarterly Compliance Report (QCR) for the period January 1 to March 31, 1997.

We have also provided with the QCR three copies of a report titled *Technical Review of the Remedial Investigation Report, Chemsol, Inc. Site*. This document provides a discussion of the differences in potentiometric water level mapping between CDM-Federal Programs (CDM) in the Remedial Investigation (RI) Report and mapping conducted by Eckenfelder, Inc. in the QCR. The Pre-Interim Groundwater Remedy water level maps presented in the QCR have been revised based on well construction information provided in the RI Report. Representatives of *de maximis, inc.* and Eckenfelder would like to meet with EPA and CDM to discuss these comments and Eckenfelder's water level mapping methods.

Please give me a call to review potential dates for another technical discussion about the RI Report.

Respectfully,

de maximis, inc.


Willard F. Potter
Facility Coordinator

Enclosures

cc: Amelia Wagner, Esq. (1)
Paul Harvey (2)
Chemsol Technical Committee - via fax only
Dan Bigler; BAI - via fax only
Mike Monteleone; Eckenfelder - via fax only

FILE COPY

**TECHNICAL REVIEW OF THE
REMEDIAL INVESTIGATION REPORT
CHEMSOL, INC. SITE
PISCATAWAY, NEW JERSEY**

Prepared for:

Chemsol Site PRP Group

Prepared by:

**ECKENFELDER INC.®
1200 MacArthur Boulevard
Mahwah, New Jersey 07430**

April 1997

9862.04

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION	1-1
2.0 TECHNICAL REVIEW OF THE REMEDIAL INVESTIGATION REPORT	2-1
2.1 Conceptual Hydrogeologic Model	2-1
2.2 General Comments - Volume 1 (Text)	2-4
2.3 General Comments - Volume 1A (13" x 20" RI Figures)	2-4
2.4 General Comments - Other Appendices	2-5
3.0 QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM	3-1
3.1 Pre-RI Pump Testing	3-1
3.2 Initial Observations	3-2
3.3 Analysis of the Hydrogeologic Data	3-3
3.3.1 Long-Term Test of CDM	3-3
3.3.2 Distance Drawdown Analyses of Packer Test Data	3-4
3.3.3 Aquifer Test of Well C-1 by McClaren-Hart	3-4
3.3.4 Neuman-Witherspoon Ratio Method Analysis of McClaren-Hart Aquifer Test	3-5
3.3.5 Theis Type Curve Matching of Time Recovery Data from Packer Test	3-5
3.3.6 Distance Drawdown Analysis of Packer Test Round 3, Test 3	3-6
3.4 Summary of Quantitative Analyses	3-6
4.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL	4-1
5.0 EFFECT OF DNAPL AND MATRIX DIFFUSION ON GROUNDWATER REMEDIATION	5-1
5.1 Impact of DNAPLs on Grounwater Restoration	5-1
5.2 The Significance of Matrix Diffusion	5-3
APPENDICES	
Appendix A - Summary of Volumes - RI Report	
Appendix B - Aquifer Test Analyses	

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Follows Page No.</u>
3-1	Summary of Aquifer Test Analyses	3-3
4-1	Well Groupings by Hydrostratigraphic Unit	4-1
4-2	Groundwater Elevations	4-2

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Follows Page No.</u>
4-1	Projected Bedrock Cross Section	4-2
4-2	Potentiometric Contour Map Wells Screened in the Overburden Zone	4-2
4-3	Potentiometric Contour Map Wells Screened in the Upper Permeable Aquifer	4-2
4-4	Potentiometric Contour Map Wells Screened in the Upper Principal Aquifer	4-2
4-5	Potentiometric Contour Map Wells Screened in the Lower Principal Aquifer	4-2
5-1	Matrix Diffusion in Fractured Rock Aquifers	5-3

1.0 INTRODUCTION

A site-wide Remedial Investigation (RI) was conducted for Operable Unit I of the Chemsol Inc. property located in Piscataway Township, New Jersey. The RI was conducted from October 1992 through November 1994 by CDM Federal Programs Corporation for the U.S. Environmental Protection Agency. The results of the RI were reported in a document titled "Remedial Investigation Report, Chemsol Inc. Superfund Site" (hereinafter referred to as the RI report), dated October 1996.

A stated objective of the RI was to provide a basis for the "technical development and detailed evaluation of the remedial alternatives in the FS [Feasibility Study]". Accordingly, the RI investigation included the installation and testing of additional monitoring wells and piezometers and the collection and analysis of samples to assess chemical constituents present within groundwater, surface water, stream sediment and soil. The RI report included a description of hydrogeologic conditions, an analysis of probable source areas and transport pathways, and a risk assessment to public health and the environment. The RI report is contained in a series of 15 volumes, which have been briefly summarized in Appendix A.

The RI has been reviewed by ECKENFELDER INC. on behalf of the Chemsol Site PRP Group. The results of this review are described in Section 2.0. In addition, a further analysis of the hydrogeologic data for the site has also been conducted, beyond that as presented in the RI. This includes a quantitative analysis of pump test data obtained during the RI and previous investigations (Section 3.0) and a re-interpretation of the conceptual hydrogeologic model for the site (Section 4.0). Finally, a discussion is presented in Section 5.0 regarding implications for groundwater remediation due to the effects of DNAPLs and matrix diffusion that should be considered in the upcoming FS.

This document is intended to facilitate a technical dialog between the USEPA and the Chemsol Site PRP Group (Group) regarding the issues related to site remediation. Specifically, it is particularly important to achieve technical concurrence regarding the conceptual hydrogeologic conditions of the site and the significance of DNAPLs and matrix diffusion as they relate to groundwater

remediation. Agreement on these and other technical issues is critical in order to provide an objective analysis of the various remedial options that will be considered as a part of the Feasibility Study.

2.0 TECHNICAL REVIEW OF THE REMEDIAL INVESTIGATION REPORT

A technical review of the RI report has been performed. The RI report presents the results of a generally well implemented field investigation. However, the narrative report is somewhat limited by a rather cursory analysis of the data, particularly as it relates to the site hydrogeologic conditions. Furthermore, the RI report could be a more useful document if it had been structured to serve as a comprehensive presentation of both the newly collected and existing site data.

The intent of this review is not to provide a point-by-point critique of each of the 15 volumes that constitute the RI report. Rather, a brief discussion is provided regarding the highlights of the document review. Most of the technical comments are relatively minor and do have a critical bearing on use of the report as it relates to site remediation. A significant exception, however, is the interpretation of the water-bearing zones beneath the site and the related implications regarding the directions of groundwater flow. The critique is presented as follows.

2.1 CONCEPTUAL HYDROGEOLOGIC MODEL

Interpretation of the site hydrogeologic conditions is based on a faulty assumption regarding the grouping of wells for mapping purposes. Specifically, the wells have been grouped, by CDM, on the basis of equal elevation rather than on the basis of stratigraphic position within the dipping bedrock units. Our experience has shown that this type of approach results in the incorrect determination of groundwater flow directions.

It was correctly stated in the RI report that the results of the packer tests should be used to group the wells for the purpose of potentiometric mapping. The following statement was made on page 3-21 leading to the discussion regarding well grouping:

"Based on the results of the packer tests, it appears that:

- the bedrock that lies stratigraphically above the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures),

- the [upper] gray shale appears to be a hydraulic barrier,
- the bedrock below the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures), and
- the deep gray unit may have some hydraulic control, but the collected data are not significant enough to make any conclusion regarding this unit."

The aforementioned conclusions, which should have been used as the basis for well grouping for potentiometric mapping by CDM, were apparently ignored in that wells were subsequently grouped entirely on the basis of elevation. The result of grouping wells in this fashion yielded the comparison of data from wells that are in disparate water-bearing zones. This is a particular problem at this site because of the significantly complex hydrostratigraphic vertical relationships between the various units, which includes a significant downward, vertical flow component. Accordingly, much of the potentiometric mapping by CDM (RI Figures 3-23 through 3-40) has yielded misinterpretation regarding the direction and magnitude of groundwater flow.

Specific comments regarding the potentiometric surface contour maps are offered, as follows:

- TW-Series Wells Above and Below the Gray Shale (RI Figure 3-23) - This map is erroneous in that it employs wells that are screened both stratigraphically above and below the gray shale and which are, thus, in two different hydrostratigraphic units. Furthermore, the wells screened above the gray shale are in an aquitard which is characterized, predominantly by a vertical, downward flow system. Accordingly, it is inappropriate to use the TW-series wells above the gray shale for the purposes of mapping horizontal gradients.

- **C-Series Wells Above the Gray Shale - (RI Figures 3-24 through 3-26) -** These maps depict the highly fractured zone immediately above the gray shale. Use of data from Well C-7 would have provided a greater spatial data distribution that may have yielded a greater predominance in the direction of groundwater flow than is observed from the small changes in the water level variations in the four closely spaced wells that were used. The RI report states that C-7 was not used because it is at a lower elevation even though it is at a stratigraphically similar position as the other C-series wells that were used.
- **C-Series Wells Below the Gray Shale - (RI Figures 3-27 through 3-33) -** The wells used to construct these maps are too small in number and are too closely spaced to yield useful information regarding groundwater flow direction at this interval. These wells can, however, be grouped with numerous other wells in a similar hydrostratigraphic zone (but at different depths) to provide maps with considerably greater geographic coverage.
- **Upper DMW/MW Series Wells (RI Figures 3-34 through 3-37) -** These maps are problematic in that they include wells screened both above and below the lower gray shale which may, therefore, be in two separate hydrostratigraphic regimes.
- **Lower DMW/MW Series Wells (RI Figures 3-38 through 3-40) -** In a similar manner as the previous maps, these maps mix wells that are screened above and below the lower gray shale.

A modified hydrogeologic model has been prepared by ECKENFELDER INC., as presented in Section 2.0 of this document. This model utilizes well groupings based on hydrostratigraphic units defined on the basis of observed stratigraphic conditions and based on response to the packer pump testing. Finally, this model presents a revised set of the potentiometric surface contour maps for the August 29, 1994, measurement date that is believed to more accurately represent the site conditions than maps presented in the RI.

2.2 GENERAL COMMENTS - VOLUME 1 (TEXT)

- The RI functions adequately as a data presentation report but lacks the depth of data analysis that is typically found in a report of this type.
- The packer testing was generally well implemented and provides invaluable data for the differentiation of the various hydrostratigraphic units. However, additional detail could have been provided regarding response to pumping if supplemental manual water level measurements were obtained from wells that were not instrumented with data loggers.
- Data are presented in various figures that are not supported in accompanying tables or in the appendices. Examples include tables that present well construction details for all (newly installed and existing) wells and water level data.
- Collection of additional full rounds of water level data prior to implementation of the interim remedy (pumping of Well C-1) would have been useful for the characterization of groundwater flow directions.
- The occurrence of DNAPLs at the site is critical to overall site remediation and should be more prominently presented in Volume I. Specifically, the text should present a more detailed discussion regarding the occurrence of DNAPLs rather than simple reference to the handwritten calculations in Appendix X. This discussion should be supported by tables and maps that describe the presence and distribution of the specific DNAPL constituents.

2.3 GENERAL COMMENTS - VOLUME 1A (13" x 20" RI FIGURES)

- The geophysical cross sections (natural gamma and caliper log) presented on RI Figures 3-5A and 3-5B have a vertical scale that is too small to adequately resolve details of the log. Furthermore, the cross sections would be much more informative if stratigraphic correlation and associated annotations were included.

2.4 GENERAL COMMENTS - OTHER APPENDICES

- The appendices should provide a comprehensive presentation of both new and historic boring and well construction logs.
- Logs of previously existing monitoring wells and piezometers should be included for reference to the newly installed wells.
- Water level data logger data tabulations (Appendix V) would be much easier to use if they were annotated with test details (e.g., test start, test stop, etc.) and if they had been provided in a computer format (on disk).
- The concentration contour maps (Appendix T-1) present a misleading depiction of the contaminant distribution for the following reasons:
 - It would be more appropriate to group the maps by hydrostratigraphic unit rather than by well depth for the same reasons as described previously for the potentiometric surface maps.
 - Complete reliance of computer contouring methods can result in misleading representations of contaminant distribution that are often too strongly controlled by individual data points (e.g., "bulls-eye" effect around individual data points). Manual contaminant contouring and the related application of professional judgment regarding the effects of groundwater flow would likely result in the preparation of maps that are more accurate.
 - The color concentration scale should be standardized for all maps. Use of the full range of colors for each map prevents the rapid visual comparison of the relative concentration differences by color. This fact obviates what is perhaps the greatest advantage in the use of color maps beyond that of simple physical attractiveness.

3.0 QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM

A quantitative analysis of the available hydrogeologic data has been conducted for the Chemsol Site. This analysis included a review of data from the RI as well as a revisit of data by AGES and McClaren-Hart to determine if additional information could be extracted from their efforts. The available data include aquifer test, slug test, and packer testing data.

This evaluation provides as much of a quantitative understanding of the hydrogeologic system as is reasonably feasible given the complex hydrogeologic system. By the term "quantitative understanding", we mean the ability to subdivide the hydrogeologic system into functional hydrostratigraphic units and assign hydrogeologic properties to these units, such as transmissivity, hydraulic conductivity, and storativity. This type of quantitative understanding of the system will be vital as a foundation for the numerical modeling of the system, even if the properties are modified (as they almost certainly will be) during the calibration of the model.

3.1 PRE-RI PUMP TESTING

In 1987, AGES Corporation performed a hydrogeologic assessment of the Chemsol site. As part of their work, they conducted a step-drawdown test of Well C-1, and a subsequent aquifer test using the same well. Extraction of much usable hydrogeologic data from the AGES work is problematic since the aquifer test at Well C-1 was begun shortly after the conclusion of the step-drawdown test and before sufficient time had elapsed for the aquifer to fully recover from the drawdown produced by the step-drawdown test.

In 1993, McClaren-Hart conducted a hydrogeologic study of the Chemsol site. As part of their work, they performed an aquifer test using Well C-1 as the pumping well and a number of wells as monitoring points. While procedurally, the work of McClaren-Hart is a considerable improvement over the earlier AGES work, analysis of the data from the aquifer test is hindered by the fact that the open interval of Well C-1 actually spans two distinct water-bearing zones and an intervening hydrostratigraphic unit (the Gray Shale), which generally acts as an aquitard. This

was not recognized in 1993. Consequently, the well likely draws an indeterminate amount of water from each zone, thus confounding precise definition of the hydrogeologic properties of either zone. Nonetheless, as will become clear subsequently, some useful data can be drawn from this test since apparently most of the water is drawn from the Principal Aquifer.

3.2 INITIAL OBSERVATIONS

Before embarking upon an in-depth assessment of the aquifer tests, slug tests, and packer tests, several general observations need to be made about the hydrogeologic system as a conceptual foundation for the subsequent analyses.

1. The observed vertical hydraulic head losses at the site are indicative of moderate to low vertical hydraulic conductivity in some zones.
2. The above observation, coupled with the relatively high yields observed in various pumping wells and packer tests, suggests a hydrogeologic system composed of interlayered aquifers and aquitards.
3. Vertical anisotropy is also indicated, certainly on a system-wide basis and probably within individual strata as well.
4. A degree of heterogeneous hydrogeologic behavior is evident in virtually all the data. This heterogeneity will certainly defy efforts to precisely model the system. Nonetheless, the generalized behavior of the system should be subject to modeling and reasonably accurate predictive analysis.
5. The heterogeneity has particular implications to the implementation of a groundwater extraction system at the site. No matter how thoroughly one probes the hydrogeologic data for insight into the properties of the system or how diligently one strives to calibrate a numerical groundwater flow model based on those calculated properties, performance of a groundwater extraction system will require careful verification. It seems inescapable that the Observational Method, in one form or another, will have to be called upon to design and construct a cost-effective system.

3.3 ANALYSIS OF THE HYDROGEOLOGIC DATA

In analyzing the hydrogeologic system at the Chemsol site, principal emphasis has been placed upon the aquifer test and packer test conducted by CDM and McClaren-Hart. In particular, CDM conducted a packer test of some duration which they termed the long-term test. This packer test was, in essence, an aquifer test and the data from this packer test are quite useful. The aquifer test conducted by McClaren-Hart in 1993 of Well C-1 is also useful. ECKENFELDER INC. has carefully evaluated all of the packer test data to see what quantitative information can be extracted from this considerable body of data. While the packer tests were primarily conducted to determine the interconnectedness of various zones, nonetheless, some of the tests lend themselves to quantitative analysis.

The packer test data were first evaluated as to whether analyses could be conducted using the Theis type curve match technique on the drawdown data. Analysis of the drawdown data, however, was not feasible due to the variable pumping rate employed in the early phase of the packer test. In most cases, the flow rate during the packer test was increased in step-wise fashion during the early part of the test, and then held relatively constant throughout the remainder of the test. While the early stepped pumping rate makes time-drawdown analysis infeasible, analysis of time-recovery data is possible since water level recoveries react more to the average pumping rate, particularly during the later phases of the test, than they do to early fluctuations in pumping rate. Distance drawdown analyses were also employed to analyze the drawdown at the conclusion of the packer test pumping. Lastly, packer test recovery data were also used to conduct Neuman-Witherspoon ratio method analyses of the upper bedrock zone above the upper permeable zone. Each of these methods of analysis is briefly described below. A summary of the results of the aquifer test analyses is presented in Table 3-1.

3.3.1 Long-Term Test of CDM

CDM performed what they termed the "Long-Term Test" as part of their packer testing activities. During the long-term test, drawdown was measured in a number of monitoring wells, and the results analyzed by CDM using the AQTESOLV®

**TABLE 3-1
SUMMARY OF AQUIFER TEST ANALYSES**

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-1	CDM	14,500	2.1×10^{-4}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-5	CDM	8,800	7.8×10^{-5}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - MW-103	CDM	8,800	2.2×10^{-4}	---
Principal Aquifer	Packer Test: Round 3, Test 2 Distance - Drawdown Analysis	ECKENFELDER INC.	>5,000	2.3×10^{-4}	---
Principal Aquifer	Neuman-Witherspoon Ratio method Analysis of McClaren-Hart Aquifer Test	ECKENFELDER INC.	---	---	3.5×10^{-4}

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**TABLE 3-1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES**

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match TW-9	McClaren-Hart	8,500	9.9×10^{-5}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match DMW-5	McClaren-Hart	10,300	4.1×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-3	McClaren-Hart	10,800	1.7×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-4	McClaren-Hart	10,800	1.9×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-5	McClaren-Hart	29,000	2.1×10^{-4}	---
Upper Permeable Aquifer	Packer Test: Theis Type Curve Match of time-recovery data Round 3, Test 3, Well C-6	ECKENFELDER INC.	12,300	1×10^{-4}	---

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**TABLE 3-1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES**

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Upper Permeable Aquifer	Packer Test: Distance-Drawdown Analysis of Round 3, Test 3	ECKENFELDER INC.	13,000	6×10^{-6}	---
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-8, TW-3	ECKENFELDER INC.	---	---	1.1×10^{-4}
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-10, TW-4	ECKENFELDER INC.	---	---	6.5×10^{-5}

100474

computer program. Three tests, in particular, provide insight into the transmissivity and storativity of the principal aquifer. These tests are the analyses conducted based upon the drawdowns observed in Wells DMW-1, DMW-5 and MW-103. These particular wells are well suited stratigraphically to determine the aquifer parameters. The results of CDM's analyses are presented in Table 3-1.

3.3.2 Distance Drawdown Analyses of Packer Test Data

Efforts were undertaken by ECKENFELDER INC. to determine whether any of the packer test data would be suitable for a distance drawdown analyses using the Cooper-Jacob method. This methodology is particularly useful in defining transmissivity. However, most of the packer tests do not lend themselves to this type of analysis for two reasons. First, there are generally not a sufficient number of wells at different radial distances from the pumped interval to define the shape of the distance drawdown curve. Secondly, the pumped interval typically cannot be used in the analysis because of excessive well losses. Nonetheless, one packer test, specifically Round 3, Test 2, provided some insight into the transmissivity in that well losses in the pumped interval in Well DMW-10 appeared to be more modest. Drawdown in the pumped interval was only 4.8 feet (compared to many tens of feet in some of the other packer tests). An analysis of this packer test using the Cooper-Jacob distance drawdown method, and assuming the drawdown in the pumped interval is reflective of actual drawdown in the formation, yields a transmissivity of 5,000 gallons per day per foot and a storativity of 2.3×10^{-4} . In all likelihood the transmissivity is higher than this figure since well losses likely occur. For example, if well losses accounted for one-half of the observed drawdown, the transmissivity would be approximately 10,000 gallons per day per foot. The plot of the data and the associated calculations are provided in Appendix B-1.

3.3.3 Aquifer Test of Well C-1 by McClaren-Hart

McClaren-Hart conducted an aquifer test of Well C-1 measuring drawdown in a number of monitoring wells. The analyses of the drawdowns observed in Wells TW-9, DMW-5, C-3, C-4, and C-5 are particularly appropriate as these wells are well positioned stratigraphically to define the aquifer parameters of the principal

aquifer. These analyses, which are presented in McClaren-Hart's report, yielded transmissivities ranging from 8,500 to 29,000 gallons per day per foot and storativities ranging from 9.9×10^{-5} to 4.1×10^{-4} , as presented in Table 3-1.

As mentioned earlier, the aquifer test conducted by McClaren-Hart of Well C-1 is limited in its accuracy due to the fact that the well is likely pumping an indeterminate amount of water from both the principal aquifer and the upper permeable zone. However, based upon the results of the analyses and a comparison to more recent aquifer tests conducted by CDM, it seems likely that the majority of the water being pumped from Well C-1 is being drawn from the principal aquifer. Consequently, it is probably reasonable to conclude that the calculated transmissivity is reasonably reflective of the Principal Aquifer.

3.3.4 Neuman-Witherspoon Ratio Method Analysis of McClaren-Hart Aquifer Test

In order to gain some insight into the vertical hydraulic conductivity of the principal aquifer, ECKENFELDER INC. conducted a Neuman-Witherspoon Ratio Method Analysis of the data from the McClaren-Hart Aquifer Test. A vertical hydraulic conductivity of 3.5×10^{-4} centimeters per second was estimated for the lower portion of the principal aquifer. These data and associated calculations are presented in Appendix B-2.

3.3.5 Theis Type Curve Matching of Time Recovery Data from Packer Test

ECKENFELDER INC. conducted Theis type curve analysis of recovery data from a number of the packer tests. One test in particular generated data permitting a Theis type curve match analysis. These data were the packer test recovery data from Round 3, Test 3 for Well C-6. This analysis permits estimation of the aquifer parameters of the upper permeable zone. The analysis resulted in an estimated transmissivity of 12,300 gallons per day per foot and a storativity of 1×10^{-4} . The data, type curve match and associated calculations are included in Appendix B-3.

3.3.6 Distance Drawdown Analysis of Packer Test Round 3, Test 3

The data from the Round 3, Test 3 packer test also lent itself to a distance drawdown analysis using the Cooper-Jacob method. In this packer test, Well C-7 in the upper permeable zone was pumped and drawdowns in Wells C-6, C-8, C-9 and C-10 were measured in the upper permeable zone. In this analysis Well C-6 and C-10 provide the most useful data since they are at significantly different radial distances from the pumped interval. This test suggests some degree of areal anisotropy with a slightly higher transmissivity along the strike of the formation. Similar anisotropy is not observed in other data sets, however, and the apparent areal anisotropy observed in Round 3, Test 3 is probably coincidental. The distance drawdown analysis results in an average transmissivity of 13,000 gallons per day per foot and a geometric mean storativity of 6×10^{-6} . The data plots and calculations are included in Appendix B-4.

Neuman-Witherspoon Ratio Method Analysis of Packer Test Round 3, Test 3

In order to get some information as to the vertical hydraulic conductivity of the upper bedrock zone, ECKENFELDER INC. conducted Neuman-Witherspoon ratio method analyses of the Round 3, Test 3 packer test. The analysis specifically involved analysis of Wells C-8 and TW-3, and C-10 and TW-4. These analyses were done using recovery data for the reasons described earlier. The time recovery plots and calculations of both ratio method analyses are presented in the appendices. The analyses resulted in estimated vertical hydraulic conductivity's of 1.1×10^{-4} and 6.5×10^{-5} centimeters per second. These analyses should probably be regarded only as order of magnitude estimates. The data plots and calculations are presented in Appendix B-5.

3.4 SUMMARY OF QUANTITATIVE ANALYSES

In connection with the principal aquifer, the average transmissivity calculated from the three Theis type curve match analyses conducted by CDM and the five Theis type curve match analyses conducted by McClaren-Hart is approximately 12,700 gallons per day per foot. Similarly, the average storativity is approximately 2×10^{-4} . The average transmissivity of the upper permeable zone, calculated from

the values obtained from the Theis type curve match of time recovery data from packer test, Round 3, Test 3 of Well C-6 and the distance drawdown analyses of packer test Round 3, Test 3 is 12,650 gallons per day per foot. The storativity is most likely on the order of 1×10^{-4} as calculated from the time recovery analysis of Well C-6. The much lower value calculated from the distance drawdown analyses is probably unrepresentative. Although some suggestion of areal anisotropy was observed in the drawdowns of Packer Test, Round 3, Test 3, generally, areal anisotropy is not indicated in the preponderance of the data. The spatial differences in drawdown seem to be more attributable to typical fractured rock heterogeneity than to a systematic areal anisotropy.

4.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL

The hydrostratigraphic setting beneath the Chemsol Superfund site is complex being characterized by a dipping, multi-layered bedrock system. Numerous monitoring wells have been installed at various depths during previous investigations in an effort to evaluate the hydrogeologic and water quality conditions.

A review of the existing hydrogeologic data for the site has been conducted by ECKENFELDER INC. to develop a refined conceptual model of the groundwater flow regime. This current understanding represents a revision of the preliminary conceptual model that was presented previously by ECKENFELDER INC. Moreover, this conceptual model represents a fundamental departure from that described by CDM in the RI report. Specifically, the current model, as presented, groups the wells for mapping purposes on the basis of stratigraphic position rather than on the basis of depth (Table 4-1).

The current conceptual model was revised on the basis of an analysis of the data from the RI report (CDM, 1996) and further review of previous site investigation data by both McClaren-Hart and AGES Corporation. A quantitative analysis of available pump test data has been presented previously in Section 3.0. This conceptual model may be subject to further revision based on the results of pending numerical modeling and/or additional field data that may be obtained in the future.

The site is conceptually subdivided into six units. This has been primarily accomplished on the basis of site stratigraphy and the observed aquifer response to the various pump tests that have been performed at the site.

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)
- Principal Aquifer
- Deep Bedrock Unit

TABLE 4-1

WELL GROUPINGS BY HYDROSTRATIGRAPHIC UNIT
Chemsol Inc. Superfund Site

Overburden Water-Bearing Zone

OW-1	OW-10	OW-12	OW-14
OW-2	OW-11	OW-13	OW-15
OW-4			

Upper Bedrock Aquitard

TW-1	TW-3	TW-5A	TW-11
TW-2	TW-4	TW-10	TW-12

Upper Permeable Aquifer

C-6	C-8	C-10
C-7	C-9	

Principal Aquifer**Upper Zone**

TW-6	TW-13	C-1	DWM-9
TW-7	TW-14	C-3	DMW-10
TW-8	TW-15	C-4	
TW-9		C-5	

Lower Zone

DMW-1	DMW-5	DMW-7	C-2
DMW-3	DMW-6	DMW-11	MW-103

Deep Bedrock Unit

DMW-2	DMW-4	MW-101	MW-104
DMW-3	DMW-8	MW-102	

The hydrostratigraphic units are depicted on Figure 4-1. Plan-view potentiometric maps (Figures 4-2 through 4-5) have been prepared that depict static pre-pumping conditions using data obtained on August 29, 1994 (Table 4-2). These include maps for the hydrostratigraphic zones in which horizontal flow predominates including the Overburden zone, Upper Permeable aquifer, and the upper and lower portions of the Principal Aquifer.

The hydrostratigraphic units are described briefly, as follows:

- Overburden Water-Bearing Zone - represents the uppermost water-bearing unit at the site. This zone is contained within the composite unit represented by the thin overburden soils and the upper veneer of highly weathered bedrock. Groundwater within this unit flows laterally toward the northeast (Figure 4-2), generally in response to ground surface topography. The overburden zone is likely to be in hydraulic communication with the small ditches and streams which flow toward the northeast across the site.
- Upper Bedrock Aquitard - is represented by the bedrock below the overburden zone. This unit is comprised of bedrock with relatively low hydraulic conductivity. The upper portion of this unit also likely represents weathered bedrock within which the joints and fractures are filled with silt or clay serving to reduce the hydraulic conductivity. Considerable vertical head loss is observed within this unit downward to the underlying Upper Permeable Aquifer. The vertical hydraulic conductivity of this unit has been determined to range from 1.1×10^{-4} to 6.4×10^{-5} cm/sec on the basis of a Neuman-Witherspoon analysis of aquifer test data, described in Section 3.0.
- Upper Permeable Aquifer - is a highly fractured bedrock zone of relatively high hydraulic conductivity that lies immediately above the upper gray shale. The presence of this unit was initially revealed in boreholes drilled during the RI. These data indicate that this zone is approximately 40 feet thick.

TABLE 4-2

**GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY**

Well	Reference	Zone (b.)	Ground	Coordinates (c.)		29-Aug-94	
	Elevation (ft., msl)		Elevation (ft., msl)	Northing	Easting	DTW (ft.)	Elev. (ft., msl)
C-1	79.83	3/4	77.60	629,997	2,062,281	--	58.50
C-2	86.24	5	--	629,865	2,061,790	--	58.36
C-3	80.52	4	78.40	629,642	2,062,565	--	58.39
C-4	80.96	4	79.00	629,636	2,062,307	--	58.20
C-5	80.10	4	78.00	629,815	2,062,297	--	58.37
C-6	76.12	3	--	630,574	2,062,609	--	59.21
C-7	80.20	3	--	630,534	2,061,803	--	59.10
C-8	81.40	3	--	630,140	2,061,554	--	59.32
C-9	85.33	3	--	629,925	2,061,589	--	59.41
C-10	80.71	3	--	630,292	2,061,975	--	59.11
DMW-1	85.40	5	82.90	629,867	2,062,117	--	58.36
DMW-2	85.07	6	83.40	629,670	2,062,085	--	57.86
DMW-3	80.49	6	78.70	629,656	2,062,566	--	58.36
DMW-4	80.44	6	78.60	629,660	2,062,532	--	57.86
DMW-5	78.89	5	77.10	630,166	2,062,022	--	58.28
DMW-6	79.23	5	77.70	630,138	2,062,030	--	58.21
DMW-7	76.62	5	75.60	630,132	2,062,439	--	58.32
DMW-8	77.77	6	76.00	630,121	2,062,428	--	57.85
DMW-9	76.35	4	--	630,578	2,062,618	--	58.18
DMW-10	79.58	4	--	630,540	2,061,816	--	58.42
DMW-11	85.04	5	--	629,918	2,061,792	--	58.31
MW-101	79.80	6	77.40	629,995	2,062,253	--	58.02
MW-102	78.69	6	77.50	629,863	2,062,471	--	57.81
MW-103	81.09	5	80.00	630,144	2,061,572	--	58.30
MW-104	88.58	6	89.00	628,957	2,062,510	--	58.42
OW-1	78.37	1	76.20	630,036	2,062,275	--	73.57
OW-2	81.64	1	79.70	629,898	2,062,206	--	78.04
OW-4	79.96	1	77.60	629,921	2,062,332	--	75.61
OW-10	79.06	1	78.30	629,660	2,062,549	--	76.83
OW-11	75.08	1	74.70	630,592	2,062,609	--	69.34
OW-12	84.65	1	--	629,888	2,061,897	--	79.61
OW-13	82.96	1	--	629,988	2,061,673	--	78.17
OW-14	92.14	1	--	629,643	2,061,657	--	83.99
OW-15	75.08	1	73.00	630,390	2,062,545	NM	NM
PZ 1	76.62	1	74.90	630,157	2,062,437	NM	NM
PZ 1D	77.05	1	--	630,172	2,062,437	NM	NM
PZ 2	76.45	1	74.50	630,051	2,062,474	NM	NM
PZ 2D	75.94	1	--	630,066	2,062,475	NM	NM
PZ 3	78.65	1	74.30	629,919	2,062,438	NM	NM
PZ 4	78.03	1	76.00	630,280	2,062,084	NM	NM
PZ 4D	78.25	1	--	630,289	2,062,090	NM	NM
PZ 5	76.68	1	74.90	630,250	2,062,208	NM	NM
PZ 5D	76.86	1	--	630,251	2,062,193	NM	NM

TABLE 4-2

**GROUNDWATER ELEVATIONS
CHEMSOI INC., SITE
PISCATAWAY, NEW JERSEY**

Well	Reference		Ground Elevation (ft., msl)	Coordinates (c.)		29-Aug-94	
	Elevation (ft., msl)	Zone (b.)		Northing	Easting	DTW (ft.)	Elev. (ft., msl)
PZ 6	76.15	1	74.20	630,227	2,062,373	NM	NM
PZ 6D	76.14	1	--	630,227	2,062,389	NM	NM
PZ 7	75.71	1	73.80	630,229	2,062,459	NM	NM
PZ 8	77.57	1	75.70	629,971	2,062,477	NM	NM
PZ 8D	77.51	1	--	629,986	2,062,477	NM	NM
PZ 9D	75.98	1	--	630,295	2,062,410	NM	NM
PZ 10D	79.08	1	--	630,086	2,062,273	NM	NM
SG@PZ 4	71.67	1	--	630,267	2,062,067	NM	NM
SG@PZ 8	73.95	1	--	629,983	2,062,495	NM	NM
TW-1	90.15	2	89.10	629,638	2,061,637	--	59.56
TW-2	85.81	2	84.20	629,900	2,061,591	--	59.98
TW-3	81.59	2	79.60	630,160	2,061,538	--	59.56
TW-4	78.31	2	76.60	630,218	2,062,010	--	59.37
TW-5	76.24	2	74.30	630,175	2,062,475	--	62.98
TW-5A	75.98	2	74.30	630,166	2,062,470	--	62.28
TW-6	78.88	4	76.70	629,894	2,062,490	--	58.76
TW-7	80.16	4	78.10	629,655	2,062,399	--	61.46
TW-8	85.11	4	83.30	629,647	2,062,102	--	59.15
TW-9	80.29	4	78.60	629,662	2,062,557	--	58.71
TW-10	79.96	2	78.50	630,549	2,061,809	--	63.45
TW-11	75.76	2	75.00	630,594	2,062,620	--	67.21
TW-12	75.73	2	73.60	630,594	2,063,195	--	65.27
TW-13	78.17	4	76.30	630,092	2,063,250	--	59.76
TW-14	89.23	4	88.60	629,332	2,061,661	--	62.01
TW-15	82.90	4	82.20	629,380	2,062,367	--	62.15

Notes:**a. Abbreviations are as follows:**

"NE" - no entry to well

"NM" - not measured

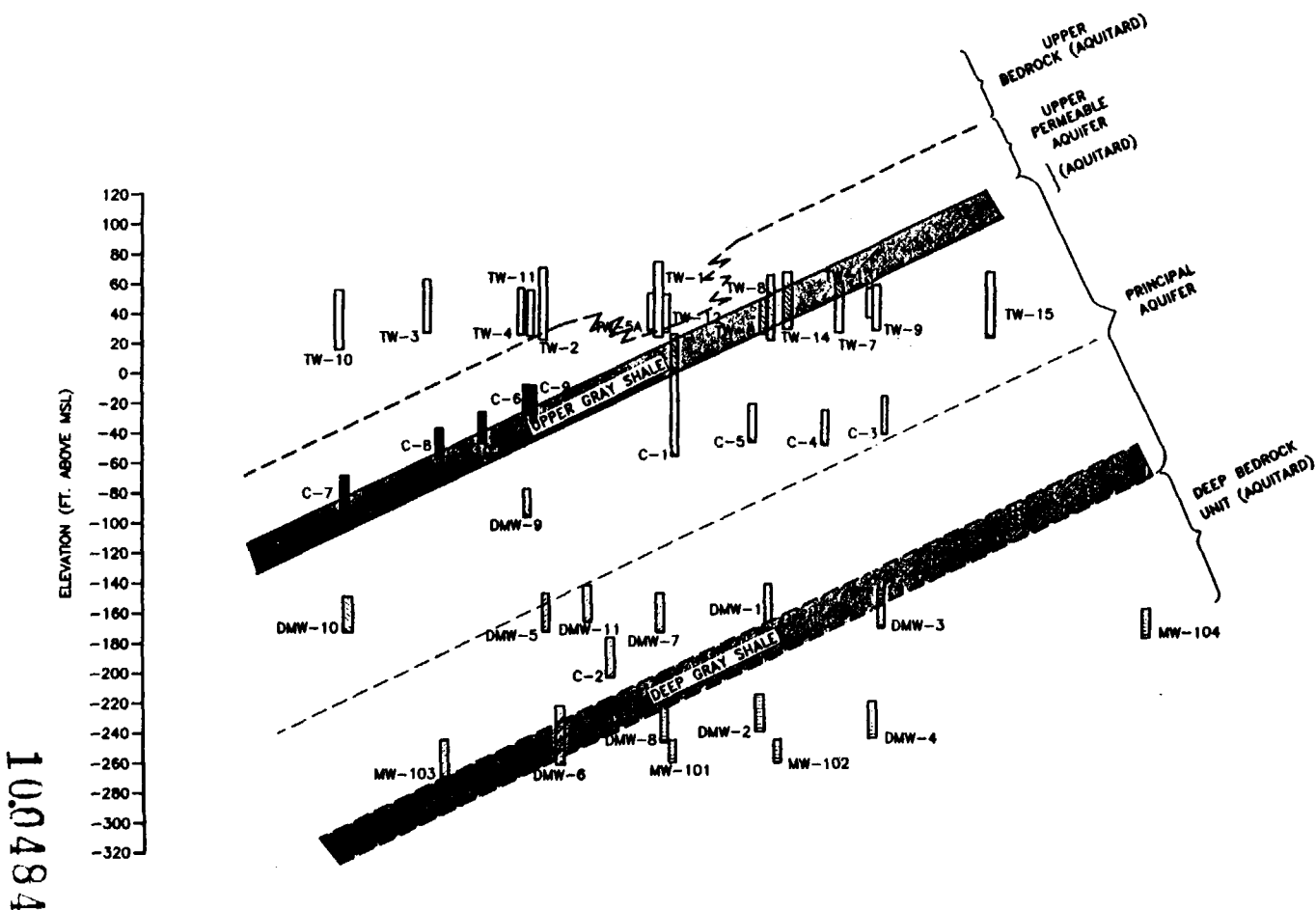
b. Wells are screened in the following zones:

1. Overburden Water-Bearing zone
2. Upper Bedrock Aquitard
3. Upper Permeable Aquifer
4. Upper of portion of Principal Aquifer
5. Lower of portion of Principal Aquifer
6. Deep Bedrock Zone

c. Northings & Eastings were obtained from surveyors coordinates, except for "PZ" wells which were obtained from a map by McLaren Hart

d. Elevations for PZ wells with D suffix were derived from McLaren Hart database.

e. Reference elevation for Staff Gauges PZ-4 and PZ-8 are for the 0 ft. mark. DTW reading is above the 0 mark.

**LEGEND:**

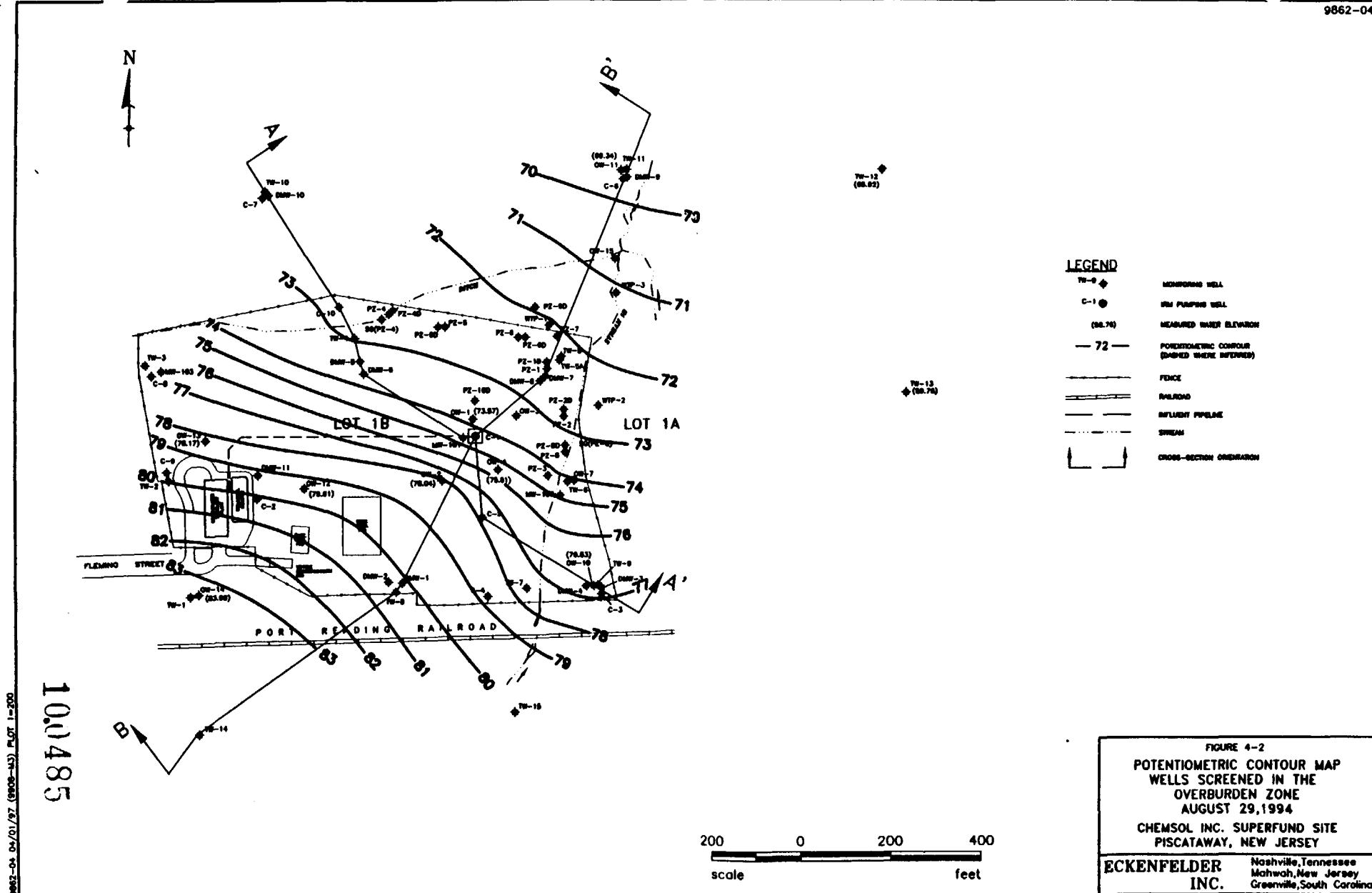
- WELLS SCREENED IN UPPER BEDROCK AQUITARD (NOT USED FOR PLAN VIEW POTENTIOMETRIC MAPPING)
- WELLS SCREENED IN THE UPPER PERMEABLE AQUIFER
- WELLS SCREENED IN THE UPPER PRINCIPAL AQUIFER
- WELLS SCREENED IN THE LOWER PRINCIPAL AQUIFER
- WELLS SCREENED IN THE LOWER BEDROCK UNIT (NOT USED FOR PLAN VIEW POTENTIOMETRIC MAPPING)

NOTES:

1. CONCEPTUAL CROSS-SECTION REPRESENTING ALL BEDROCK WELLS PROJECTED TO A CONCEPTUAL ORIENTATION, ALIGNED PARALLEL TO DIP.
2. ADAPTED FROM RI FIG. 3-3, (CDM,1996)
3. ASSIGNMENT OF WELLS TO VARIOUS HYDRO STRATIGRAPHIC UNITS IS BASED LARGELY ON OBSERVED RESPONSES TO PUMPING.

FIGURE 4-1

**PROJECTED BEDROCK
CROSS SECTION**CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, N.J.**ECKENFELDER
INC.**Nashville, Tennessee
Metuchen, New Jersey
Greenville, South Carolina



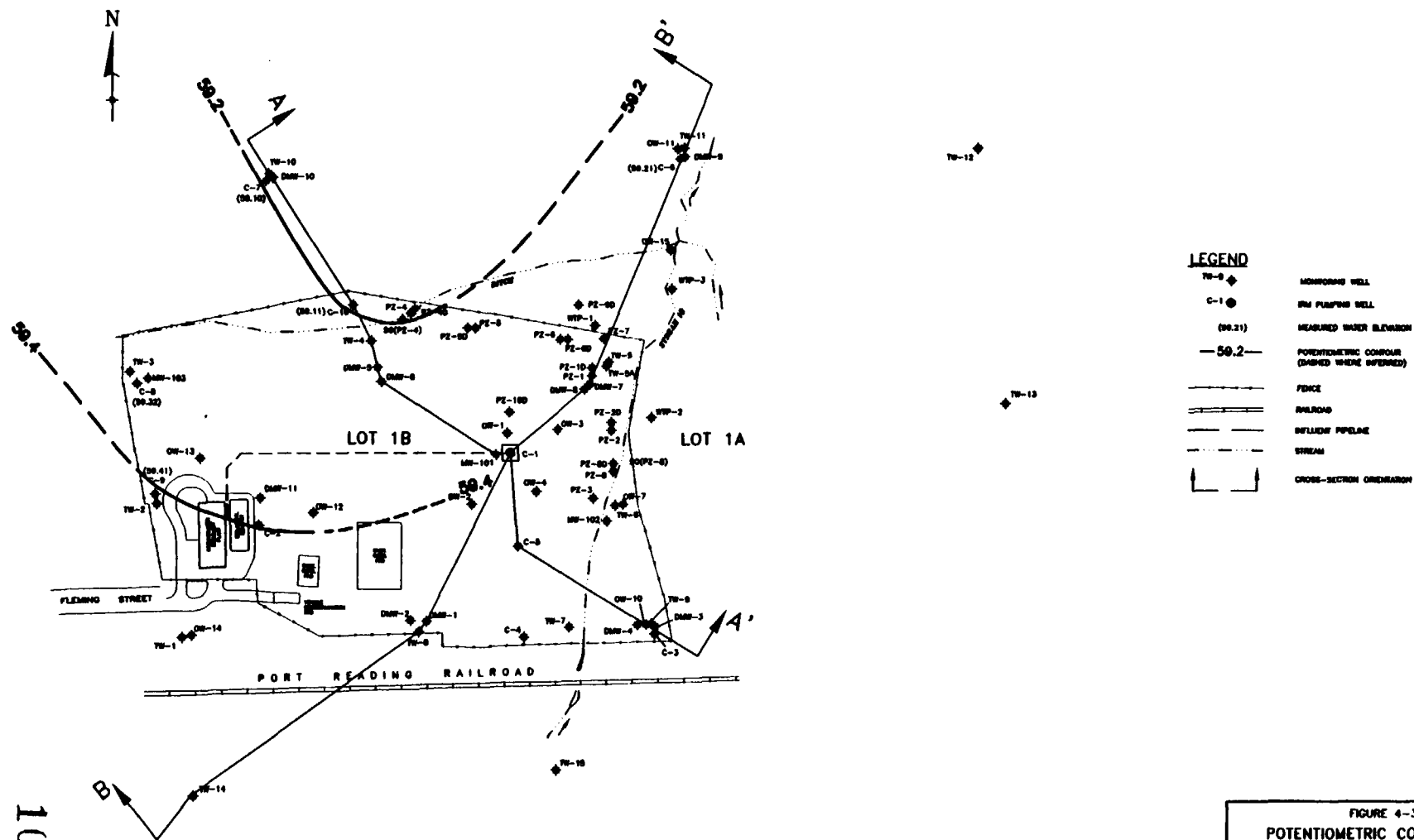


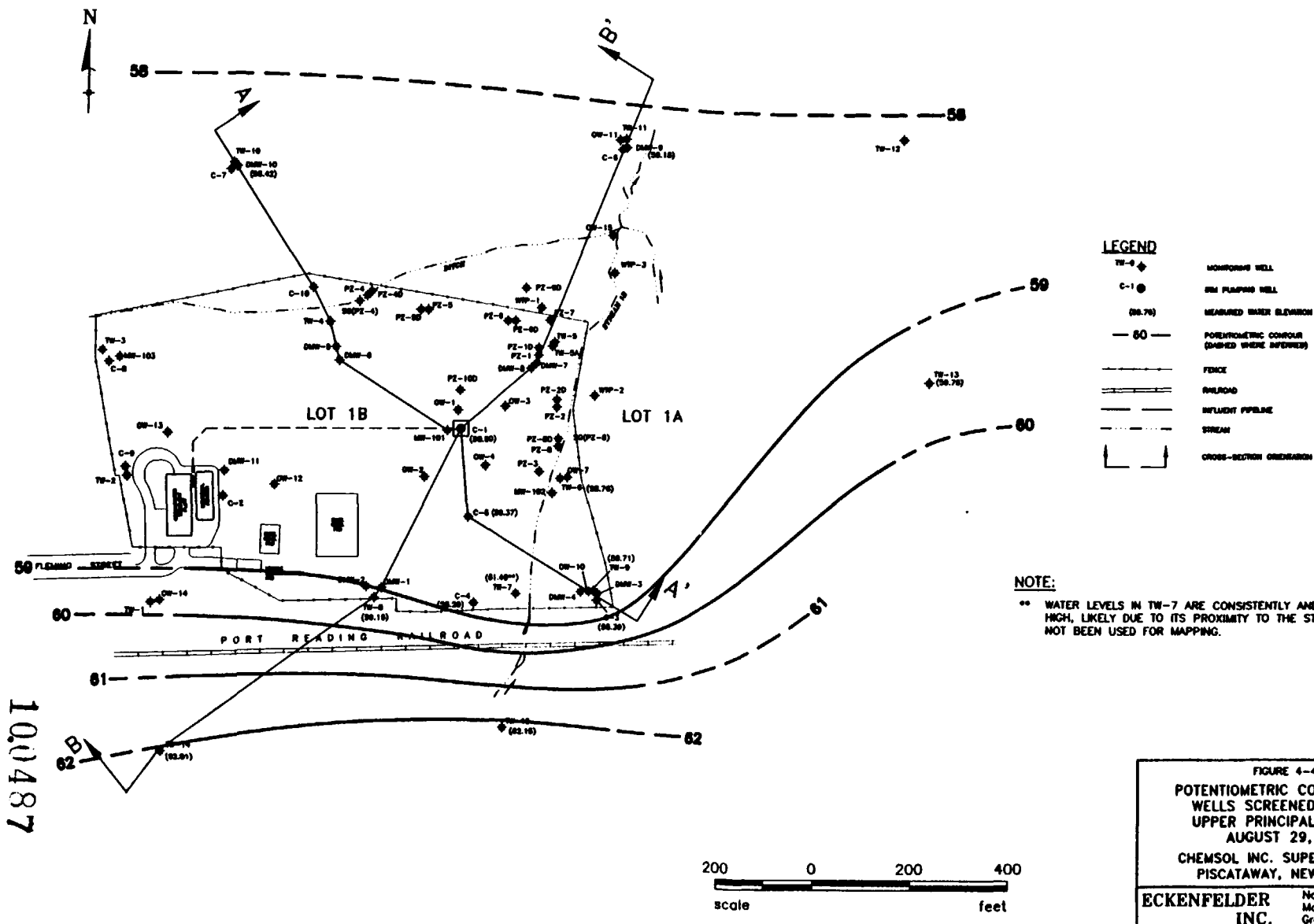
FIGURE 4-3
POTENTIOMETRIC CONTOUR MAP
WELLS SCREENED IN THE
UPPER PERMEABLE AQUIFER
AUGUST 29, 1994

CHEMSOL INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

ECKENFELDER
INC.

Nashville, Tennessee
Mahwah, New Jersey
Greenville, South Carolina

200 0 200 400
scale feet



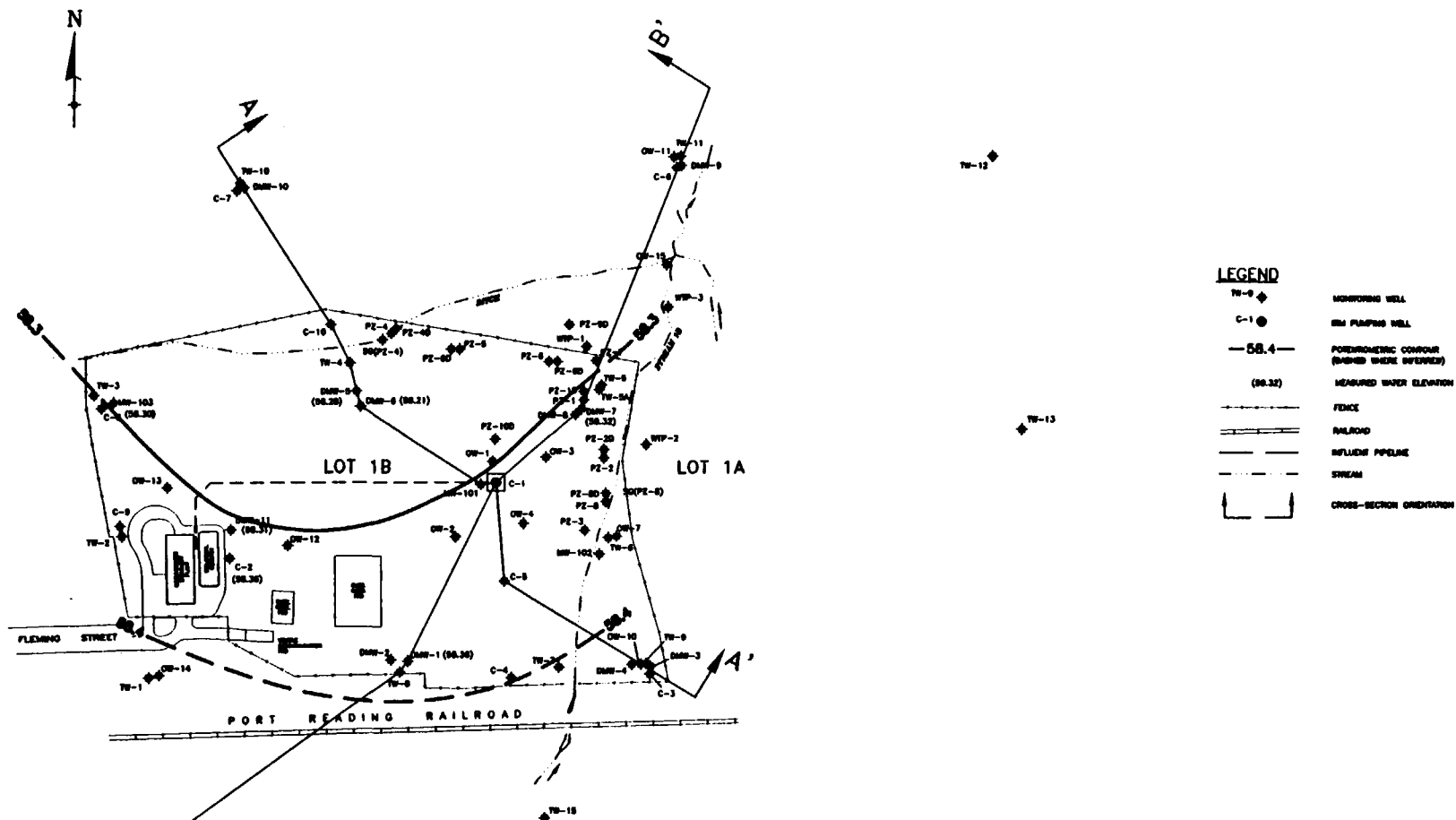


FIGURE 4-5
 POTENTIOMETRIC CONTOUR MAP
 WELLS SCREENED IN THE
 LOWER PRINCIPAL AQUIFER
 AUGUST 29, 1994

CHEMSOL INC. SUPERFUND SITE
 PISCATAWAY, NEW JERSEY

ECKENFELDER
 INC.

Nashville, Tennessee
 Mahwah, New Jersey
 Greenville, South Carolina

The transmissivity of the Upper Permeable aquifer has been determined to be approximately 13,000 gpd/ft on the basis of aquifer testing described in Section 3.0. Groundwater flow within this unit is predominantly horizontal with a relatively flat hydraulic gradient to the northeast, as shown on Figure 4-3.

- Upper Gray Shale (Aquitard) - Analysis of aquifer test data indicate that the Upper Gray shale provides hydraulic separation between the Upper Permeable Aquifer and the Principal Aquifer. This separation is also observed in the vertical head losses observed between the two aquifers across the Upper Gray shale.
- Principal Aquifer - is comprised of the bedrock zone between the upper and deep gray shale beds with a thickness of approximately 180 feet. The transmissivity of this unit has been shown to be typically on the order of 12,700 gpd/ft with a storativity of approximately 2×10^{-4} , as described in Section 3.0.

Slight downward gradients are observed within the Principal aquifer so that it has been subdivided into upper and lower portions for mapping purposes. Wells screened in the contiguous upper and deep gray shale units have been observed to be in sufficient hydraulic communication with the Principal aquifer that they have been included in the potentiometric mapping of this unit. Potentiometric maps for the upper and lower portions of this unit (Figures 4-4 and 4-5, respectively) reveal a northerly direction of groundwater flow.

- Deep Bedrock Unit - includes the bedrock below the deep gray shale. The deep gray shale provides some hydraulic separation between the Principal aquifer and the deep bedrock, determined on the basis of aquifer testing. Insufficient data are available in this unit to determine the horizontal direction of flow.

5.0 EFFECT OF DNAPL AND MATRIX DIFFUSION ON GROUNDWATER REMEDIATION

The primary objective of groundwater extraction, at the Chemsol site, should be to provide hydraulic containment of the groundwater plume for the prevention of further downgradient migration. Conversely, little in the way of meaningful groundwater restoration can be accomplished at this site through efforts to remove contaminant mass by groundwater extraction. This is due to the presence of dense non-aqueous phase liquids (DNAPL) and the significance of diffusion into the bedrock matrix to the practicability of groundwater restoration.

5.1 IMPACT OF DNAPLS ON GROUNDWATER RESTORATION

The RI report concluded that DNAPLs likely exist in numerous overburden and bedrock wells at the Chemsol site. This is based primarily on comparison of groundwater quality data to constituent solubilities using USEPA methodology described in its guidance "Estimating Potential for Occurrence of DNAPL at Superfund Sites" (USEPA, 1992). The fact that analysis of rock core samples by ultraviolet florescence (as a part of the RI) did not reveal NAPL is not surprising given the fact the that chlorinated organics typically do not fluoresce. However, the RI provides additional evidence of DNAPL in the presence of material resembling "tar balls" that have been observed during maintenance of the groundwater extraction treatment system.

Dense non-aqueous phase liquids (DNAPLs) are a class of chemicals with relatively low solubility in water which are therefore capable of moving as a separate phase through groundwater systems. In addition, they have densities greater than that of water so that they tend to sink vertically through aquifers. These factors, coupled with the fact that many of the DNAPL chemicals are considered potentially harmful at even low part per billion levels, dictate that even relatively small amounts of DNAPL can contaminate large portions of an aquifer.

Trichloroethylene (TCE) is shown, in the RI, to be one of the more prevalent DNAPL compounds at the Chemsol site. Of particular note is this compound's solubility. From one perspective, the solubility is sufficiently low that this chemical will, in

fact, behave as a separate phase in groundwater before ultimately being solubilized. However, from another perspective, it can be seen that the solubility is six orders of magnitude higher than the groundwater cleanup standards. Consequently, in spite of the relatively low solubility compared to other chemicals, the solubility of TCE is sufficiently high to render groundwater non-potable even when concentrations are only a minute fraction of the solubility limits.

The importance of DNAPL, where present, has been recognized since the early 1980s regarding the ultimate remediation of sites. More recently, the regulatory agencies have begun to acknowledge the occurrence and problems presented by the presence of DNAPL chemicals at sites. One of the more important acknowledgments is presented in the 1992 USEPA guidance, as follows:

"Once in the subsurface, it is difficult or impossible to recover all of the trapped residual DNAPL. The conventional aquifer remediation approach, groundwater pump-and-treat, usually removes only a small fraction of trapped residual DNAPL. Although many DNAPL removal technologies are currently being tested, to date there have been no field demonstrations where sufficient DNAPL has been successfully recovered from the subsurface to return the aquifer to drinking water quality."

The presence of DNAPL in bedrock further complicates site remediation through inaccessibility (e.g., in dead-end fractures of bedrock), flow mechanics independent of groundwater flow, complex flow patterns, and difficulties in locating DNAPL accumulations to name a few.

USEPA (1993) has recognized these difficulties in the TI guidance document:

"Delineation of the extent of the DNAPL zone may be difficult at certain sites due to complex geology or waste disposal practices. In such cases, the extent of the DNAPL zone may need to be inferred from geologic information (e.g., thickness, extent, structure, and permeability of soil or rock units) or from interpretation of the aqueous concentrations of contaminants derived from DNAPL sources." (USEPA, 1993, p. 8)

The absence of the observation of large quantities of visible DNAPL (e.g., as "free product") during the RI and in previous investigations is completely consistent with the presence of DNAPL at the site. Recent research has shown that actual DNAPL would not likely persist in appreciable quantities in the fractures at the site given the time since manufacturing operations at the site were discontinued. The research indicates that DNAPL is likely to diffuse from the fractures into the matrix of the rock on a time scale that varies from as little as a few days to perhaps as much as ten years. Since the site ceased operations more than 30 years ago, it is unlikely that significant DNAPL would remain in pooled form. The diffusion of contaminants into the rock matrix, both from DNAPL and from the dissolved phase, presents the single most significant limitation to aquifer restoration at the Chemsol site. The influence of matrix diffusion is discussed in more detail below.

5.2 THE SIGNIFICANCE OF MATRIX DIFFUSION

As noted above, the presence of contamination within the rock matrix itself is of particular importance to our ability to achieve groundwater restoration within a *reasonable* time frame. (USEPA [1993] has used a time period of 100 years or more in its discussions regarding what constitutes a reasonable time frame for aquifer restoration). The entrance to and eventual release of contaminants from the rock matrix is a diffusion controlled process. DNAPL chemicals in rock fractures and dissolved within groundwater establish the concentration gradients that drive diffusive transport into the rock matrix. The matrix diffusivity of the rock has the single most significant influence on the rate of movement of contaminants into and out of the bedrock matrix. Further, even after a source of contamination is removed, diffusion into the rock matrix can continue due to internal concentration gradients set up during the contamination phase. Contaminants in the rock matrix become a long-term source of groundwater contamination for which there is no remedial measure currently available. One would expect groundwater remediation time within rock aquifers contaminated with DNAPL chemicals to be measured in hundreds of years.

As contaminated groundwater moves through the fractures of a bedrock aquifer, diffusion of contaminants will occur into the essentially stagnant matrix pore water of the rock, as illustrated in Figure 5-1. The extent of the diffusion and its

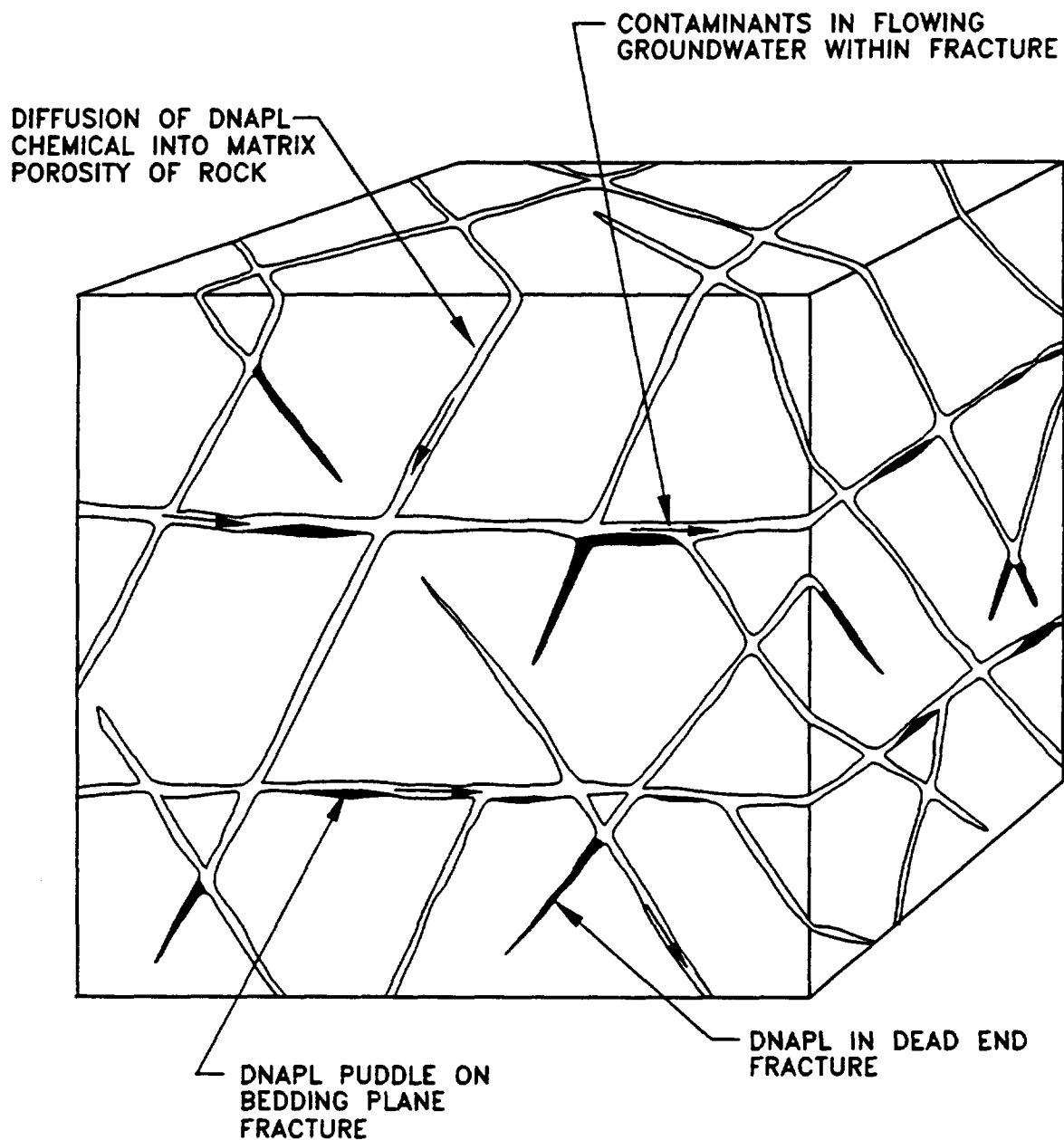


FIGURE 5-1

MATRIX DIFFUSION IN FRACTURED ROCK AQUIFERS

**ECKENFELDER
INC.**

Nashville, Tennessee
Mahwah, New Jersey

SOURCE: MUTCH, R.D. AND SCOTT, J.I. (1993)

hydrogeologic significance will depend upon the concentration gradient, the matrix diffusivity and porosity, the fracture spacing of the rock, and the duration of exposure. From one perspective, the diffusion of contaminants into the rock matrix is beneficial in that it retards the advance of a contaminant plume through the fractured rock. Lever and Bradbury (1985) reported that matrix diffusion can lead to effective retardation factors in excess of 100 and can reduce peak concentrations by three to four orders of magnitude, provided that the groundwater velocity is relatively small. However, when the objective is to purge contamination from an aquifer, the diffusion-controlled release of contaminants from the rock matrix can greatly prolong aquifer cleanup efforts over what would be possible in a simple porous medium of equivalent hydraulic conductivity.

It is important to recognize that the significance of matrix diffusion to groundwater restoration is not limited to the DNAPL zone. In fact, the diffusion process will play a similar role in substantially delaying the removal of mass in the area of the aqueous plume downgradient of the DNAPL zone. USEPA has also acknowledged the significance of this phenomena:

"EPA recognizes, however, that there are technical limitations to groundwater remediation technologies unrelated to the presence of a DNAPL source zone. These limitations, which include contaminant-related factors (e.g., slow de-sorption of contaminants from aquifer materials) and hydrogeologic factors (e.g., heterogeneity of soil or rock properties), should be considered when evaluating the technical practicability of restoring the aqueous plume." (USEPA, 1993, p.9)

Groundwater extraction in fractured bedrock for the purpose of contaminant mass removal is likely to meet with only limited success in restoring the quality of water in a reasonable period of time. In particular, over-pumping to increase flow rates appreciably beyond those required to prevent further migration of the contaminant plume is not likely to result in significant benefits due to "rebound" effects that usually occur upon the cessation of pumping. In fractured rock aquifers, the rate of cleanup is controlled by the rate of contaminant diffusion from the rock matrix into the fractures--a process which cannot be significantly enhanced by increasing groundwater velocities in the fractures, since increasing fracture flow velocity

generally only marginally increases the concentration gradient between the rock matrix and the fracture flow system and has no effect on the low diffusivity of the contaminant in the porous medium. Thus, the rate of diffusion and the rate of cleanup are increased only marginally by pump and treat operations under these conditions.

In summary, the use of groundwater extraction for the purpose of contaminant mass removal will have little overall effect on groundwater quality conditions. This is due to the presence of DNAPLs in bedrock and the recognition of the significance of matrix diffusion in groundwater restoration efforts. Accordingly, the overall goal of groundwater extraction should be to achieve hydraulic containment of the migrating groundwater plume.

APPENDIX A
SUMMARY OF VOLUMES
RI REPORT

**SUMMARY OF REMEDIAL INVESTIGATION REPORT
CHEMSOL INC. SUPERFUND SITE
CDM Federal Programs Corporation
October 1996**

An outline of the Remedial Investigation (RI) report prepared by CDM Federal Programs Corporation for USEPA is presented herein. In addition, text sections of the RI report have been briefly summarized.

Volume I - (RI Report text)

1.0 Introduction

2.0 Study Area Investigations

A description of the RI field investigation was provided, which included the following:

- Two (2) rounds of ambient air quality samples; 1993 and 1994
- Two (2) rounds of surface water and sediment quality samples; 1992 and 1993
- Bedrock core samples collected from six (6) boreholes
- Gridded soils samples taken at 102 locations
- Installation of eight (8) bedrock and three (3) overburden monitoring wells
- Downhole geophysical logging conducted in 30 new and existing wells
- Packer pump testing in three (3) rounds
- Two (2) rounds of water level measurements
- Two (2) rounds of groundwater quality samples in 1994
- Ecological Investigation of the Chemsol property and surrounding properties

3.0 Physical Characteristics of the Chemsol Site

A rather brief discussion of site characteristics including meteorology, air quality, surface water and sediment, geology, hydrogeology, soils biota, demographics and land use. The primary conclusions made by CDM regarding geologic and hydrogeologic conditions are summarized below:

- The site is underlain by the Brunswick formation with a strike and dip of N59° E and 9° NW, respectively.
- A gray shale bed and/or a highly fractured zone above it have the characteristics of a hydraulic barrier.
- Beds above and below the gray shale bed are described by CDM to be nearly isotropic and homogeneous even though groundwater flow is controlled by fracture orientation.

SUMMARY OF REMEDIAL INVESTIGATION REPORT (Continued)
CHEMSOL INC. SUPERFUND SITE
CDM Federal Programs Corporation
October 1996

- It is not conclusive if a deep gray shale bed acts as a hydraulic barrier.
- Downward vertical gradients are observed across the site.
- Wells were grouped based on equal elevation on either side of the gray marker bed for the purpose of isot potentiometric mapping.
- Groundwater in the uppermost water bearing zone (OW- wells) flows to the northeast.
- The direction of groundwater flow in deeper zones is not well defined and is shown to flow in various directions, dependent upon the group of wells that is mapped.
- Residential water supply wells in the Nova-Ukraine neighborhood are not in hydraulic communication with the site
- Off-site groundwater pumping may influence the direction of groundwater flow.

4.0 Nature and Extent of Contamination

- Air sampling data indicate no clear evidence of significant off-site contamination from the Chemsol site.
- Surface water sediment data were reported to contain VOCs, SVOCs (primarily PAHs), pesticides, PCBs, and various metals.
- Surface water samples contained VOCs, low levels of several pesticides, and several metals.
- Soil data revealed exceedances of NJ proposed soil cleanup criteria for a number of constituents including PCBs, several VOCs, SVOCs, pesticides and metals including lead.
- Groundwater contamination consists largely of chlorinated VOCs. The highest concentrations are found in the center of the site. However, significant VOCs in the deeper bedrock are also found at the northeast edge of the property.

SUMMARY OF REMEDIAL INVESTIGATION REPORT (Continued)
CHEMSOL INC. SUPERFUND SITE
CDM Federal Programs Corporation
October 1996

- VOC concentrations exceed 1% of solubility at many locations indicative of the presence of DNAPLs.

5.0 Contaminant Fate and Transport

General discussion regarding various routes of contaminant migration and the persistence of various constituents in the environment.

6.0 Baseline Human Health Risk Assessment

The following exposures were determined by CDM to exceed the USEPA acceptable risk ranges:

- Carcinogenic risks due to potential future residential exposure to surface soil and groundwater
- Non-carcinogenic risks due to present and potential future exposure to surface soil and groundwater, and potential exposure to construction workers via groundwater ingestion.

7.0 Ecological Risk Assessment

The following conclusions are made by CDM regarding ecological risk:

- Exposure of ecological receptors to subsurface soil and groundwater contamination is not likely.
- A potential exists for adverse effects on selected indicator species, including shrews, robins and red-tailed hawks, due to exposure to surface soils.
- There is little or no ecological risk associated with surface water or sediment.

8.0 Summary and Conclusions

9.0 References

Volume IA

Set of 11" x 20" figures to accompany Volume I (text) of the RI.

SUMMARY OF REMEDIAL INVESTIGATION REPORT (Continued)
CHEMSOL INC. SUPERFUND SITE
CDM Federal Programs Corporation
October 1996

Volume II

- Appendix A - Drilling Logs
- Appendix B - Coring Logs
- Appendix C - Well Construction Logs
- Appendix D - Downhole Geophysical Logging Data
- Appendix E - Packer Testing Figures/AQTESOLV Graphs
- Appendix F - Soil Boring Logs
- Appendix G - PCB Field Screening Logs

Volume III

- Appendix H - Sampling Trip Reports

Volume IV - (CLP data summary sheets)

- Appendix I - Air Sampling Results - Form One
- Appendix J - Surface Water/Sediment Sampling Results - Form One

Volume V & VI - (CLP data summary sheets)

- Appendix K - Soil Sampling Results - Form One

Volume VII & VIII - (CLP data summary sheets)

- Appendix L - Groundwater Sampling Results - Form One

Volume IX - (BHHRA & ERA backup)

- Appendix M - 95 Percent Upper Confidence Limit Calculations
- Appendix N - Toxicological Profiles
- Appendix O - Spreadsheet Calculations
- Appendix P - Central Tendency Calculations
- Appendix Q - Threatened and Endangered Species/Significant Habitats
- Appendix R - Ecological Exposure and Toxicity

Volume X - (formatted analytical data tables)

- Appendix S - EDM Data Tables (Air, Surface Water, Sediment, Soil, & Groundwater)

SUMMARY OF REMEDIAL INVESTIGATION REPORT (Continued)
CHEMSOL INC. SUPERFUND SITE
CDM Federal Programs Corporation
October 1996

***Volume XI - (11" x 17" color drawings)**

Appendix T - GEOSOF Concentration Contours - Groundwater
Appendix U - GEOSOF Concentration Contours - Soil

Volume XII, XIII, XIV - (data logger data)

Appendix V - Packer Testing Data (Rounds 1, 2, & 3)

Volume XV

Appendix W - Soil Averaging
Appendix X - Estimating Potential for Occurrence of DNAPL

Evaluation of exceedances of 1% of effective solubility of organic constituents per USEPA methodology revealed the likely presence of DNAPL in 23 wells, listed as follows:

OW-1	C-1	TW-1	MW-104	DWM-1
OW-2	C-2	TW-4		DWM-3
OW-4	C-5	TW-5		DWM-7
OW-12	C-7	TW-5A		DWM-8
	C-10	TW-7		DWM-9
		TW-8		DWM-11
		TW-15		

APPENDIX B
AQUIFER TEST ANALYSES

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APPENDIX B-1

Distance-Drawdown Analyses of RI Packer Test Data Well DMW-10 (Round 3, Test 2)

100503

$r_0 = 1100 \text{ ft}$

$Q = 138 \text{ gpm}$
 $t = 27.5 \text{ min}$
 $\approx 0.46 \text{ hrs}$

DISTANCE DRAWDOWN ANALYSIS
OF PUMPS TEST 2
PRINCIPAL WATER

0.00500 0.00019

NATURAL DRAWDOWN
IN FORMATION PROBABLY
LESS THAN 4.9 FT
OBSERVED IN PUMPS
INTERVAL

WELL
LOSSES?

DRAWDOWN IN
PUMPS INTERVAL
= 4.9 FT

$\Delta s_2 = 138$

MINIMUM TRANSMISSIVITY

$$T = \frac{528 Q}{\Delta s_2}$$

$$T = \frac{528(138)}{138} = 500 \text{ gpm/ft}$$

$$S = \frac{Q}{T r_0^2}$$

$$S = \frac{0.00500(138)(0.9)}{(1100)^2}$$

$$S = 0.3 \times 10^{-4}$$

1. ASSUMES NO WELL LOSSES

0.1 10.0504

10 DISTANCE IN FEET

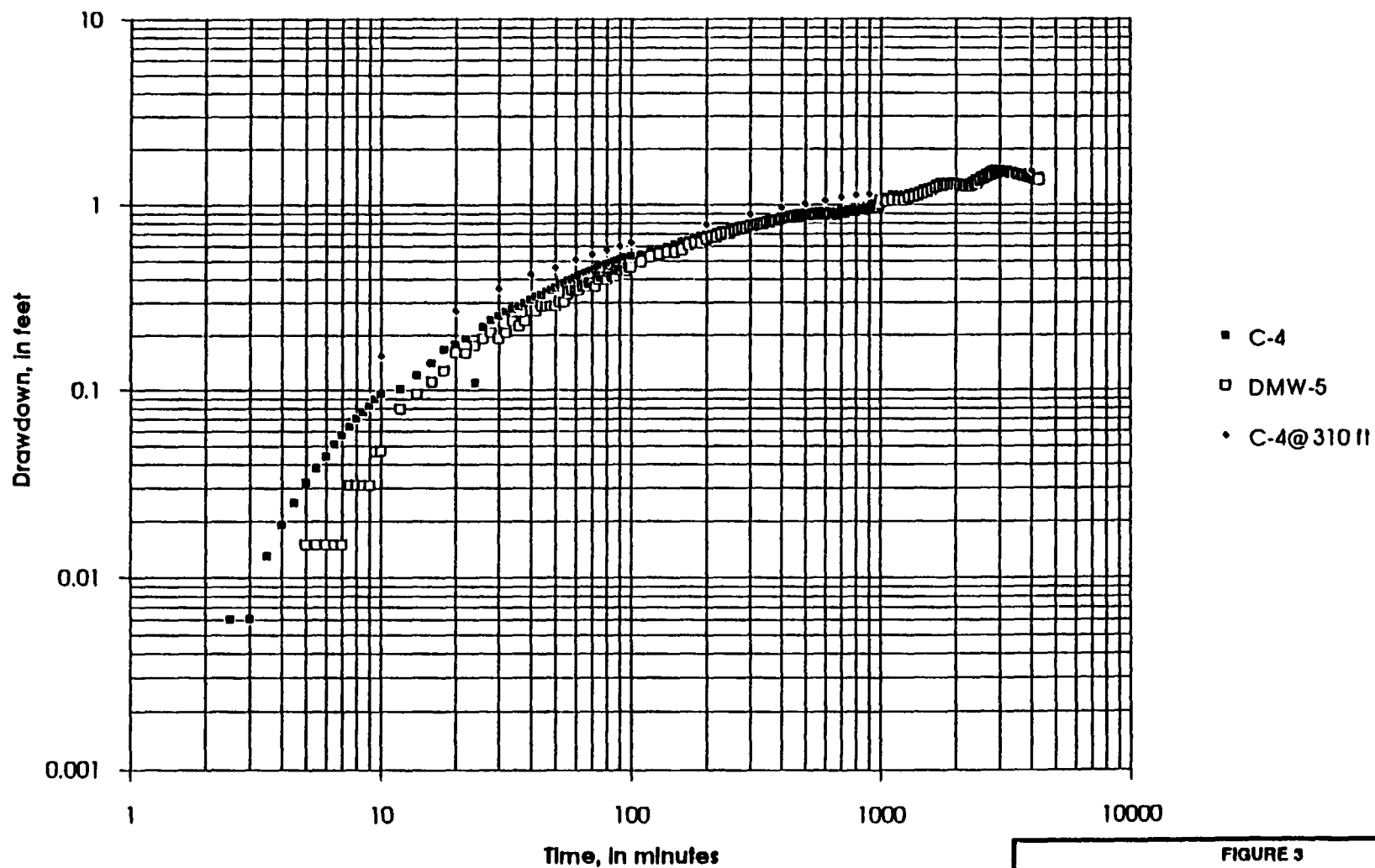
100

1000

APPENDIX B-2

Neuman-Witherspoon Analyses of McClaren-Hart Aquifer Test Data

100505



Radial Distances: C-4, 360 ft; DMW-5, 310 ft

10 minutes
 $k = 3.5 \times 10^{-4} \text{ cm/sec}$

30 minutes
 $k = 3.5 \times 10^{-4} \text{ cm/sec}$

FIGURE 3

**Time Drawdown Curves
 October 1992 Aquifer Test**

Chemco Site Trust
 Placataway, New Jersey

**ECKENFELDER
 INC.®**

Nashville, Tennessee
 Mahwah, New Jersey
 Greenville, South Carolina

10.0506

New Analysis of C-4 and DMW-5 ≈ 60 ftCalculation of K' at $t = 10$ min

$$t_D = \frac{9.28 \times 10^{-5} (10,800) 10}{(310)^2 1.9 \times 10^{-4}}$$

$$t_D = 0.54$$

$$\frac{s'}{s} = \frac{0.05}{0.15} = 0.33$$

$$t_D' = 1.9 \text{ (from graph)}$$

$$\alpha' = \frac{1.077 \times 10^{-4} (60)^2 1.9}{10}$$

$$\alpha' = 7.4 \times 10^6$$

$$K' = 7.4 \times 10^6 (1 \times 10^6) = 7.4 \text{ gpa/ft}^2 \\ = 3.5 \times 10^{-4} \text{ cm/sec}$$

C-4 and Amw-5

$t = 30 \text{ mins}$

$$t_D = \frac{9.28 \times 10^{-5} (10,800) 30}{(310)^2 1.9 \times 10^{-4}}$$

$$t_D = 1.6$$

$$\frac{S'}{S} @ 30 \text{ min} = \frac{0.20}{0.35} = 0.57$$

$$t_D' = 5.7$$

$$\alpha' = \frac{1.077 \times 10^4 (60)^2 5.7}{30}$$

$$\alpha' = 7.4 \times 10^6$$

$$K' = 7.4 \times 10^{-6} (1 \times 10^{-6})$$

$$= 7.4 \text{ gpd/ft}^2$$

$$= 3.5 \times 10^{-4} \text{ cm/sec}$$

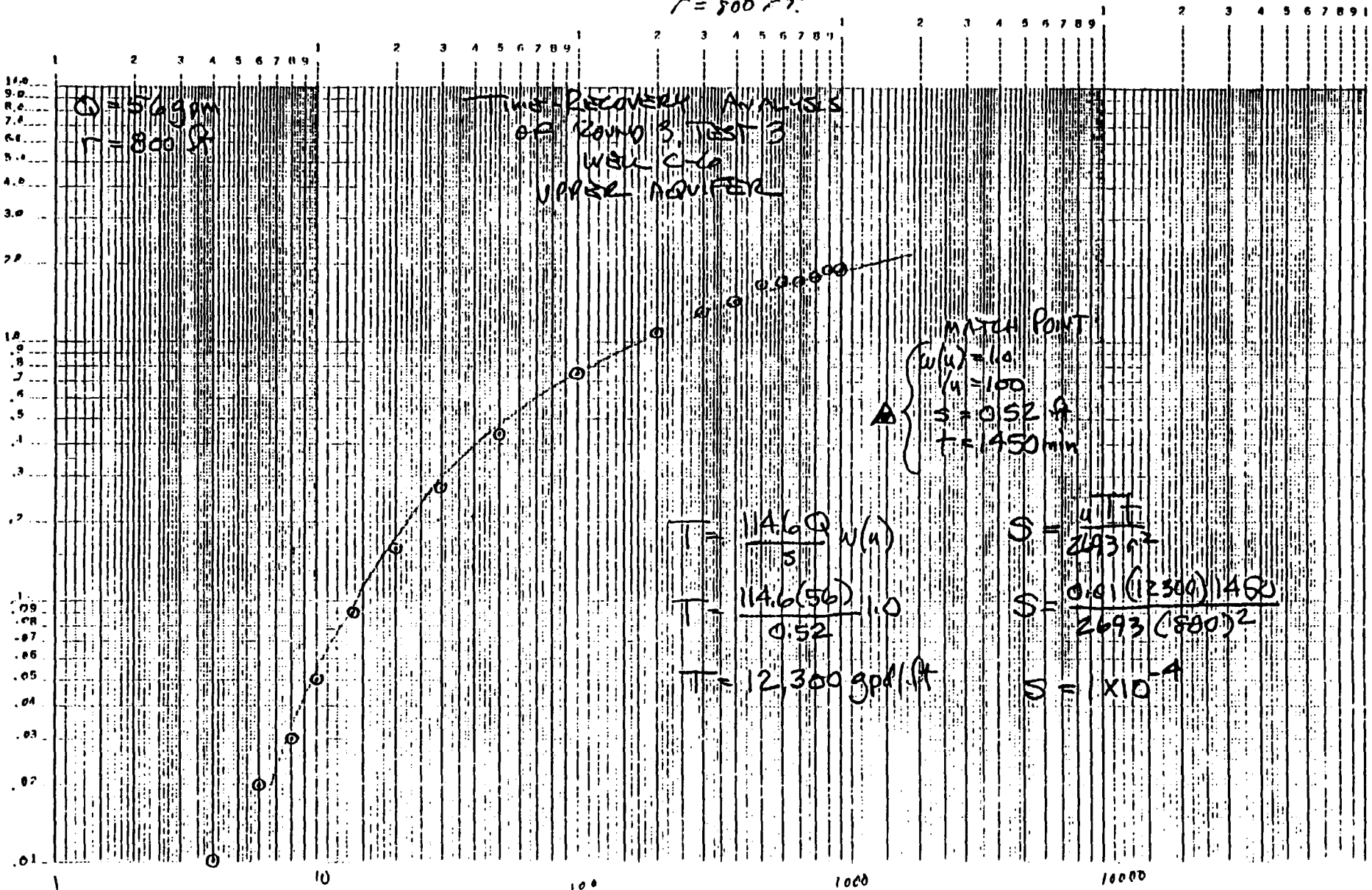
APPENDIX B-3

Theis Type-Curve Analyses of Recovery Data From RI Packer Test Well C-6 (Round 3, Test 3)

10.0509

WELL C-6 (ROUND 3, TEST 3)

r = 800 FT.



Time (min)

START PUMP 10:24 3/11
STOP PUMP 14:30 3/11

Q = 56 gpm

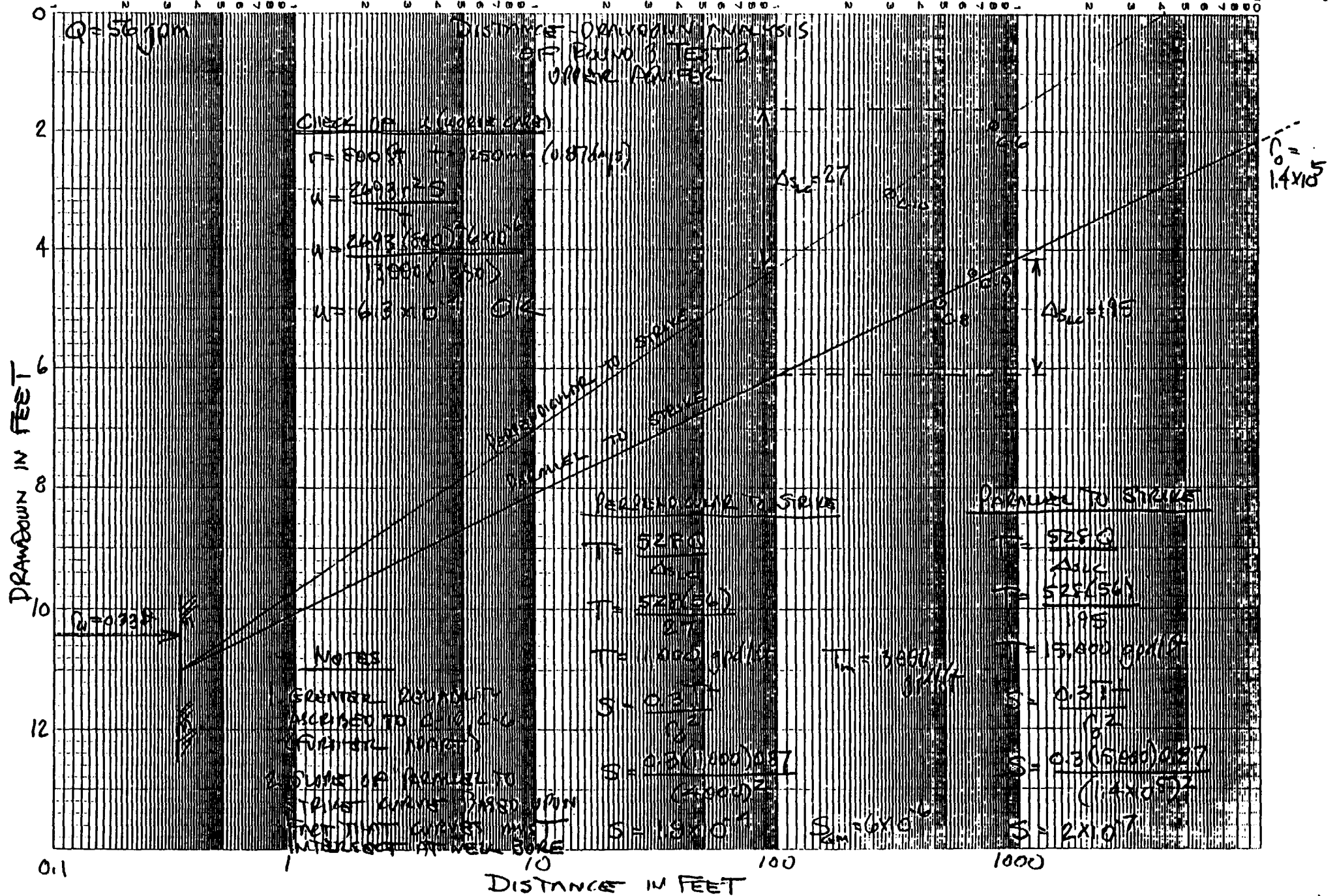
10.0510

APPENDIX B-4

**Distance-Drawdown Analyses of
RI Packer Test Data
Well C-7 (Round 3, Test 3)**

10.0511

$C_0 = 4000$

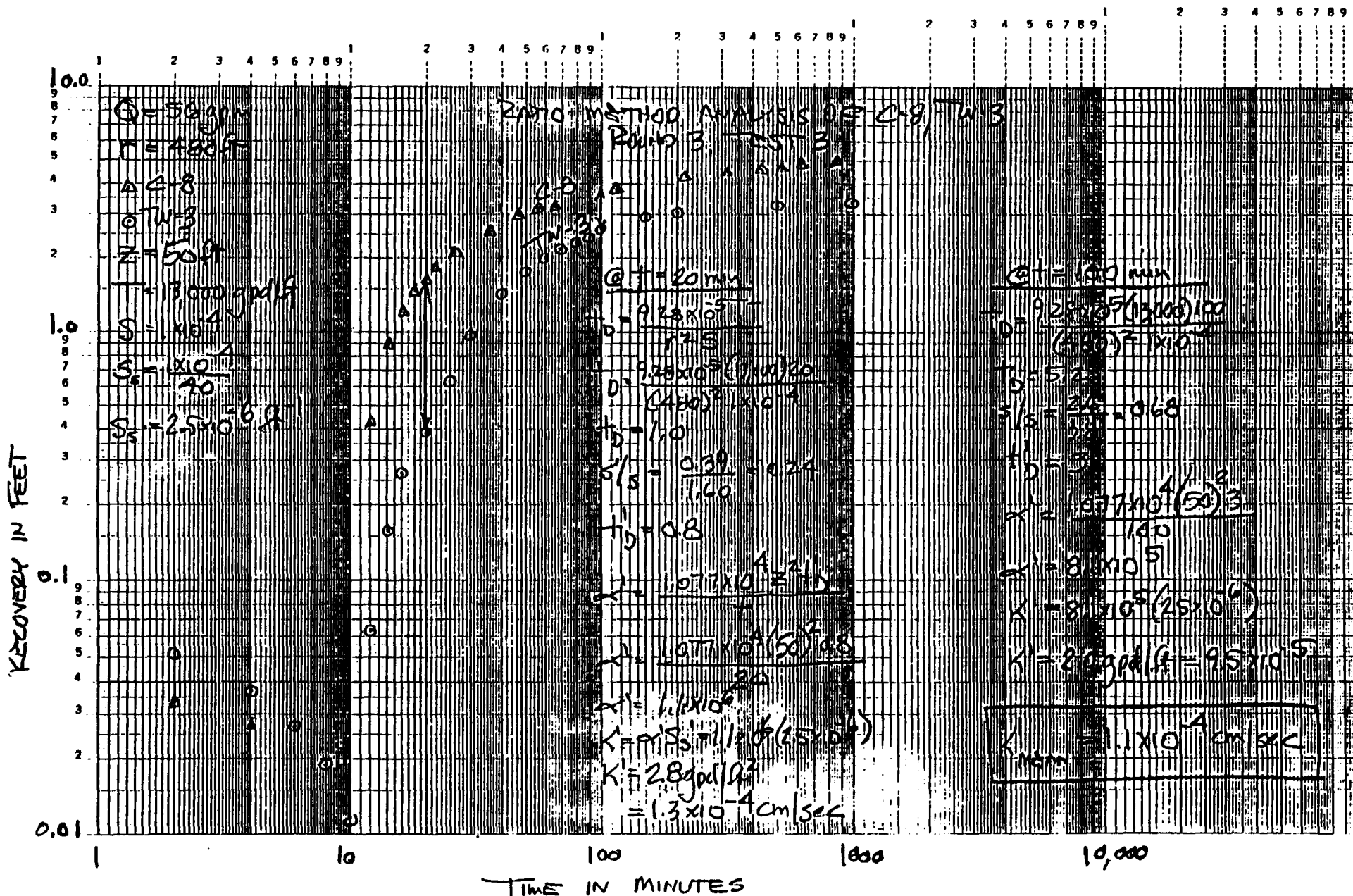


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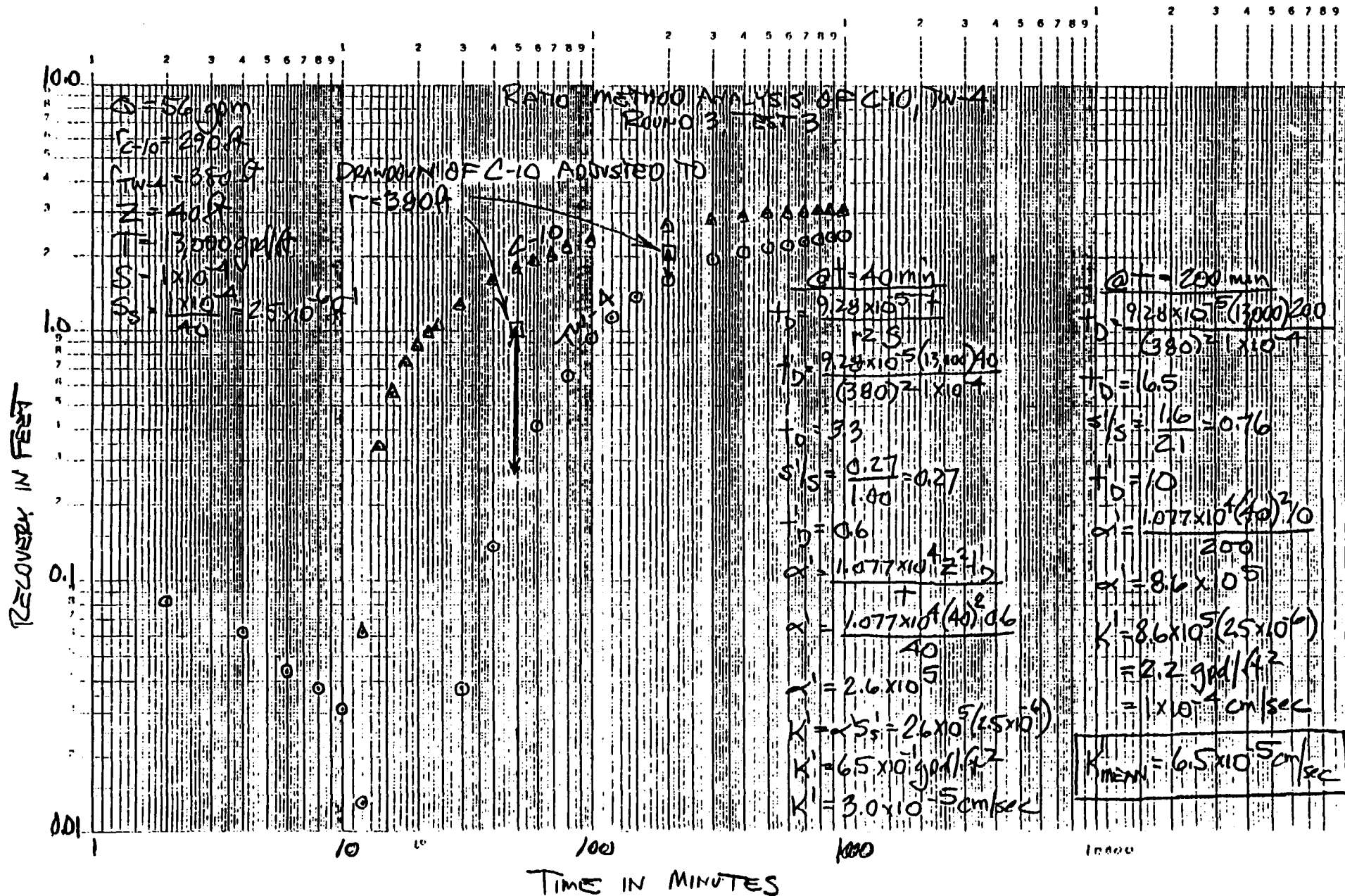
APPENDIX B-5

**Neuman-Witherspoon Analyses of
RI Packer Test Data
(Round 3, Test 3)**

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Chemsol, Inc. Superfund Site

Appendix - C

Proposed Plan

Chemsol, Inc. Superfund Site

Piscataway
Middlesex County, New Jersey



Region 2

August, 1997



MARK YOUR CALENDAR

August 11 - September 10,
1997:

Public Comment period on the
Proposed Plan for the Chemsol
Site.

Wednesday, August 27, 1997,
7:00pm:

Public Meeting at the
Piscataway Municipal Complex

COMMUNITY ROLE IN SELECTION PROCESS

EPA relies on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each Superfund site. To this end, the RI/FS report, Proposed Plan, and supporting documentation have been made available to the public for a public comment period which begins on August 11, 1997 and concludes on September 10, 1997.

A public meeting will be held during the public comment period at the Piscataway Municipal Complex on August 27, 1997 at 7:00 pm to present the conclusions of the RI/FS, to elaborate further on the reasons for recommending the preferred remedial alternative, and to receive public comments.

PURPOSE OF PROPOSED PLAN

This Proposed Plan describes the alternatives that the U.S. Environmental Protection Agency (EPA) considered in addressing soil and groundwater contamination at the Chemsol Site (Site) located in Piscataway, New Jersey. The plan also identifies EPA's preferred remedial alternative and the rationale for this preference. This document was developed by EPA, in consultation with the New Jersey Department of Environmental Protection (NJDEP). The alternatives summarized here are described in greater detail in the Feasibility Study, which is now available at the Kennedy Library, Piscataway, New Jersey.

EPA's preferred remedial alternative addresses both the soil and groundwater. Alternative S-3 is the preferred alternative for contaminated soil. Alternative S-3 provides for excavation and off-site disposal of approximately 18,500 cubic yards of contaminated soils. The excavated areas would be backfilled with imported clean fill from an off-site location, and covered with topsoil, then seeded with grass.

Alternative GW-5 is the preferred alternative for remediation of contaminated groundwater on the Chemsol property. Alternative GW-5 includes installation of additional extraction wells to contain the contaminated groundwater on the Site. The preferred alternative is similar to the existing interim groundwater remedy except that additional extraction wells would be pumped. The existing treatment facility would not be changed. Alternative GW-5 will contain most contaminated groundwater at the Site. However, EPA will undertake groundwater investigations outside the property boundaries to determine whether contaminated groundwater is leaving the site even after remedy implementation.

EPA encourages the public to review and comment on all of the alternatives considered by EPA in this Proposed Plan. The remedy described in this Proposed Plan is EPA's preferred remedy for the Site. Changes to the preferred remedy or a change from the preferred remedy to another remedy may be made if public comments or additional data indicate that such a change will result in a more appropriate remedy. EPA, in consultation with NJDEP, will select the remedy after taking all public comments into consideration.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD), the document which formalizes the selection of the remedy. All written comments should be addressed to:

Nigel Robinson
Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, NY 10007

Copies of the RI/FS report, Proposed Plan, and supporting documentation are available at the following repositories:

Kennedy Library
500 Hoes Lane
Piscataway, NJ 08854
(908) 463-1633

and

PRINTED ON RECYCLED PAPER

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USEPA Region II
Superfund Document Center
290 Broadway -18th Floor
New York, NY 10007
By Appointment: (212) 637-4308
Monday-Friday: 9:00am - 4:30pm

EPA, after consultation with NJDEP, will select a remedy for the Site only after the public comment period has ended and the information submitted during that time has been reviewed and considered. EPA is issuing this proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and Section 300.430(f) of the National Contingency Plan (NCP).

SITE BACKGROUND

Chemsol, Inc. (Chemsol) is located on a 40 acre tract of land at the end of Fleming Street, Piscataway, Middlesex County, New Jersey. The Site is comprised of two areas: an undeveloped parcel known as Lot 1A and a cleared area referred to as Lot 1B. Two small intermittent streams (Stream 1A and Stream 1B) and a small trench, known as the Northern Ditch, drain northward across the Site into a marshy wetland area located near the northeastern property boundary (see Figures 1 and 2).

Land use in the vicinity of the Site is a mixture of commercial, industrial, and residential uses. The Port Reading Railroad is directly south of the Site. Single family residences are located immediately to the west and northwest of the Site. An apartment complex with greater than 1,100 units is located to the north. Industrial and retail/wholesale businesses are located to the south and east of the Site.

Approximately 180 private wells at residential and commercial addresses were reported by the local health departments to be potentially active (i.e., not sealed) within a radius of two miles of the Site. Twenty-two of these wells are located at a distance less than 1/2 mile from the Site. The nearest public water supply well is over two miles away in the Spring Lake area of South Plainfield.

Chemsol operated as a solvent recovery and waste reprocessing facility in the 1950's through approximately 1964. The facility was closed after a series of industrial accidents, explosions and fire. In 1978, the property was

rezoned from industrial to residential. The Site is currently owned by Tang Realty Corporation. In September 1983, the Chemsol Site was formally placed on the National Priorities List (NPL) making it eligible for federal funds for investigation of the extent of contamination and, for cleanup activities.

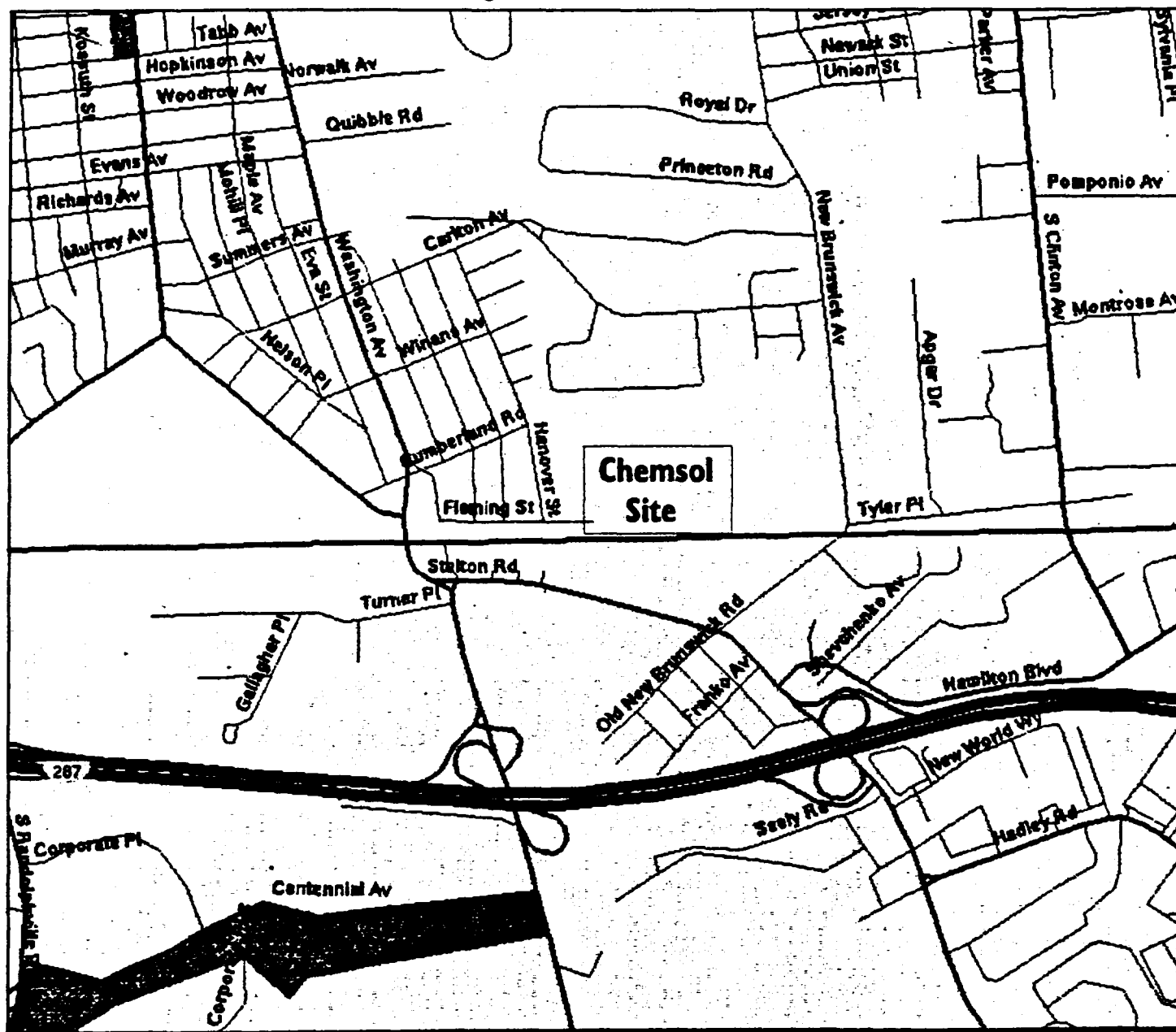
From 1983 to 1990, NJDEP directed Tang Realty, under various enforcement actions, to perform a series of Site investigations related to groundwater and soil contamination. Approximately 40 groundwater monitoring wells were installed on or in the vicinity of the Site by contractors for Tang Realty. Sampling results from these monitoring wells indicated that groundwater was contaminated with various volatile organic compounds (VOCs) including trichloroethylene, chloroform, chloroethane, toluene, carbon tetrachloride and methylene chloride. Furthermore, sampling and analyses of the soils (performed between 1980 and 1987) revealed the presence of polychlorinated biphenyls (PCBs) and other organic compounds.

In the Summer of 1988, Tang Realty removed approximately 3,700 cubic yards of PCB-contaminated soils for off-site disposal. During the soils excavation, several thousand small (less than 1 gallon) containers of unknown substances were discovered. These unknown substances were stored in a trailer on-site. As a part of an EPA removal action undertaken in 1990 and 1991, these unknown substances were analyzed, grouped with other compatible Site wastes, and transported off-site. Approximately 10,000 pounds of crushed lab pack bottles, 13,500 pounds of hazardous waste solids, 615 gallons of hazardous waste liquids and 150 pounds of sulfur trioxide were disposed of off-site during the removal action. This removal action was completed in October 1991 by EPA.

In the fall of 1990, EPA and the NJDEP agreed that EPA should fund the remainder of the investigatory work. Subsequently, EPA initiated a Remedial Investigation and Feasibility Study (RI/FS) in order to assess the nature and extent of contamination at the Site and to evaluate remedial alternatives. EPA determined that the RI/FS would be performed in two phases. The first phase consisted of development of a Focused Feasibility Study (FFS) to evaluate the usefulness of an interim remedy to restrict off-site migration of contaminated groundwater. The second phase was to determine the nature and extent of contamination at the Site.

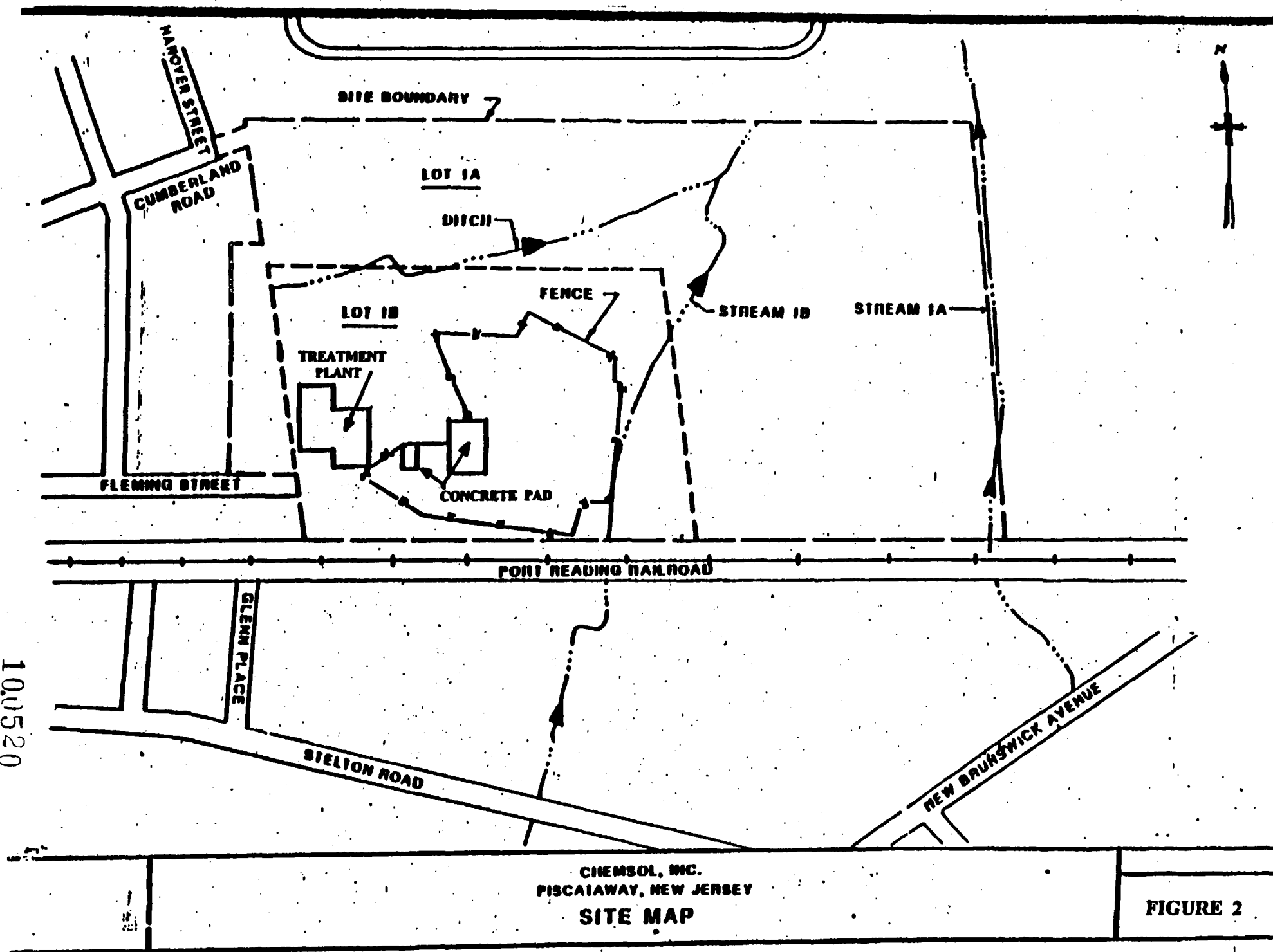
10.0518

Figure 1: Site Location



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As part of the FFS, EPA sampled 22 on-site monitoring wells. The results of the FFS indicated that groundwater at the Site exists in a perched water zone (at depths of less than five feet), and also in the upper bedrock aquifer (to depths of at least 130 feet). Sampling results revealed that groundwater was highly contaminated with a wide variety of hazardous substances, including volatile organics, semi-volatile organics, as well as pesticides and inorganic compounds.

Based on the results of the FFS, EPA selected an interim remedy for the Chemsol Site in a Record of Decision (ROD) that was signed on September 20, 1991. The objective of this interim remedy was to restrict the migration of the contaminated groundwater until a more comprehensive Site-wide remedy could be performed. The interim remedy consists of pumping groundwater from well C-1, a former monitoring well installed by Tang Realty's contractors found to be highly contaminated with VOCs. The pumped groundwater from C-1 is then treated on-site through an air stripper, after which it is filtered, followed by treatment by activated carbon.

On March 9, 1992, EPA issued a Unilateral Administrative Order (UAO) to Tang Realty, Schering Corporation, Union Carbide Corporation and Morton International, Inc. (the Respondents) for performance of the interim remedy. Schering Corporation, Union Carbide Corporation and Morton International, Inc. were identified by EPA as potentially responsible for the contamination at the Site by having sent their waste to the Chemsol Site for reprocessing. And Tang Realty was identified as the owner of the property.

In November 1993, the Respondents requested that the interim remedy be modified so that water from the treatment system could be discharged into the sewer system that leads to the Middlesex County Utilities Authority (MCUA), instead of into an on-site surface water body, as specified in the ROD. As a result, in July 1994, EPA issued an Explanation of Significant Differences which modified the interim remedy to allow for discharge of treated groundwater to the sewer system. However, EPA also required that the Respondents design and build the biological portion of the treatment system so that, in the future, if the treated groundwater could not be sent to MCUA, the biological system could be brought quickly online to allow for direct discharge of treated groundwater to Stream 1A on-site.

Construction of the groundwater treatment plant was completed by the Respondents in June 1994 and the plant was brought into operation in September 1994. The well has been pumped at varying rates, averaging

approximately 25 gallons per minute. The results of monthly monitoring indicate that the interim remedy has been partially effective in restricting the migration of highly contaminated groundwater from the Site.

REMEDIAL INVESTIGATION SUMMARY

The second phase of the RI, which was conducted to determine the nature and extent of the contamination at the Site, was completed in October 1996. During this phase, EPA's consultant installed groundwater monitoring wells, conducted sampling of the various media at the Site including air, sediment, surface water, surface soil, subsurface soil, and groundwater..

Soil Investigation

A soil sampling program was designed based on historical Site usage, aerial photographs and the findings of previous investigations. Samples were taken using an extensive grid system. Group A samples were collected at 200 foot grid spacing in Lot 1B and 400 foot grid spacing in Lot 1A. These samples were analyzed for a full range of organic and inorganic contaminants. Group B samples were collected from Lot 1B at 100 foot grid spacing and field screened for PCBs. Group C samples were collected from biased sampling locations based on aerial photographs and previous investigations and on a 50 foot grid spacing around those Group B samples which showed PCBs in their field screening results. In addition, samples from Lot 1B were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP), a test which is used to determine whether a material is a hazardous waste, regulated by specific federal and State hazardous waste regulations. In addition, subsurface soil samples were taken from 102 locations across the Site.

The results of the RI show that the surface and subsurface soils in Lot 1A and Lot 1B contain various contaminants. The contaminants found were: VOCs including carbon tetrachloride, trichloroethane, trichloroethene, tetrachloroethene, toluene, ethylbenzene, and xylenes; semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons, phthalates, pesticides (such as aldrin, dieldrin, and DDE) and PCBs; and, inorganics including manganese and lead. The range of concentrations of certain contaminants detected in surface and subsurface soil is presented in Table 1.

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Of the contaminants found, PCBs contributed the most to the risks at the Site (see the section entitled "Summary of Site Risk," below). The VOCs were found to be co-located with the PCBs and lead; therefore, any action taken to address PCBs and lead would also address the VOCs.

Groundwater Investigation

As a part of the RI, additional groundwater monitoring wells were installed. Two rounds of groundwater sampling were performed during the RI. Samples were collected and analyzed from the 49 wells on the Site. However, certain property owners adjacent to the Site continue to deny EPA access to install groundwater monitoring wells on their properties. EPA will try to resolve these access issues.

The geologic formation which underlies the Site is commonly referred to as the Brunswick formation and lies generally 3 to 14 feet below the ground surface. The Brunswick formation is generally referred to as bedrock and contains areas of red shale, gray shales and siltstones. A gray shale layer acts to preclude groundwater flow in some areas and separates the bedrock into an upper zone which is located above the gray

TABLE -1
CONTAMINANTS IN SURFACE AND SUBSURFACE SOILS

Contaminants	Concentrations Surface Soil (parts per billion)	Concentrations Subsurface Soil (parts per billion)
VOLATILE ORGANICS		
Carbon Tetrachloride	0 - 5,000	680-1700
Trichloroethene	3,500 - 32,000	3 - 18,000
Tetrachloroethene	0 - 7,000	2 - 12,000
1,1,2,2, - Tetrachlorethane	15 - 110	4 - 9,000
Chlorobenzene	0 - 3,300	4 - 8,300
Xylene (Total)	56,000 - 110,000	2 - 40,000
Toluene	2 - 380,000	10 - 27,000
Ethybenzene	2,900 - 15,000	8 - 8,800
SEMI-VOLATILES		
Bis(ethylhexyl) phthalate	0 - 63,000	66 - 17,000
Naphthalene	29 - 18,000	44 - 3,800
1,2,-Dichlorobenzene	200 - 1,600	34 - 10,000
PESTICIDES/PCB		
Aldrin	58 - 8,300	0.3 - 2,000
Dieldrin	43 - 13,000	1.1 - 130
4,4-DDE	0 - 4,600	0.13 - 120
Toxaphene	0 - 3,400	-
PCBs	540 - 310,000	21 - 2,600
INORGANICS		
Manganese	30.4 - 1,840 (parts per million)	282 - 2,300 (parts per million)
Lead	7 - 1,920 (parts per million)	2.4 - 914 (parts per million)

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TABLE - 2
CONTAMINANTS IN GROUNDWATER

Contaminants	Concentrations (parts per billion)
VOLATILE ORGANICS	
Carbon Tetrachloride	2 - 35,000
Trichloroethene	0.9 - 180,000
Tetrachloroethene	1 - 5,700
Chlorobenzene	4 - 4,200
Xylene (Total)	1 - 5,700
Toluene	2 - 27,000
Ethylbenzene	11 - 1,600
Vinyl Chloride	3 - 3,310
Benzene	1 - 16,000
2-Butanone	270 - 21,000
Chloroform	1 - 55,000
1,2-Dichloroethene	0.5 - 39,000
SEMI-VOLATILES	
1,2-Dichlorobenzene	2 - 3,300
PCBs	0 - 10
INORGANICS	
Manganese	6.1 - 19,100
Aluminum	63.9 - 61,000

10.0523

shale, and a so-called "deep gray unit" and a deep gray unit bedrock zone. The Brunswick formation is overlain by a thin layer of overburden which consists of unconsolidated sand, silt, clay and cobble deposits and fill. This overburden was determined to be typically 3 to 6 feet thick.

Groundwater flow at the Site is very complex. There is perched groundwater present in the overburden. However, the primary groundwater flow is through interconnected fractures in the bedrock. Due to the unpredictable nature and distribution of these fractures, the precise direction of flow and the rate of groundwater flow can be difficult to predict. In general, groundwater in the upper zone, above the gray shale, flows to the south. Below the gray shale, groundwater generally flows to the north. Near the southern boundary of the Site, groundwater is influenced by off-site commercial pumping activities to the south.

With regard to chemical contamination, the RI confirmed that well C-1 was by far the most contaminated of all on-site monitoring wells. The results also confirmed that VOCs are the primary contaminants in groundwater. The major VOC contaminants include benzene, carbon tetrachloride, chloroform, 1,2-dichloroethane, 1,2-dichloroethene, tetrachloroethene, toluene and trichloroethene. The bedrock aquifer is contaminated far in excess of EPA's Safe Drinking Water Act maximum contaminant levels (MCLs) which are the federal regulatory standards for drinking water. The analytical results also indicate that MCLs for aluminum, iron and manganese have been exceeded in many wells at the Site. Although many pesticides were detected in the groundwater, no MCLs were exceeded. In the second round of sampling, PCBs slightly in excess of MCLs were found in two wells, C-1 and TW-4 (see Table 2).

Groundwater contamination is present in the bedrock aquifer at both the northern and southern boundaries of the Site. Evaluation of the hydrogeological data indicates that contaminated groundwater continues to migrate off-site. However, due to the influences of groundwater pumping from off-site sources and the limited amount of off-site groundwater sampling data, there remains uncertainty as to the extent of this migration. Additional off-site sampling is required to further define the extent and source of off-site contamination. EPA's consultant used mathematical modeling to help determine the optimum pumping plan

which would best capture contaminated groundwater and minimize the amount of contaminated groundwater which leaves the Site. The modeling showed that, by pumping five additional wells, the contamination could be contained on-site except for the deep bedrock groundwater in the northwest corner of the Site.

In addition, during the RI, EPA conducted an assessment to determine whether contamination previously detected in the Nova-Ukraine section of Piscataway was related to the Chemsol Site. The Nova-Ukraine is a housing development whose nearest part is located approximately 900 feet south-southeast of the Chemsol Site. Residential wells in this development had been sampled several times since 1980 by various government agencies and private consultants. Due to concentrations of VOCs in the wells, NJDEP delineated an Interim Groundwater Impact Area for a portion of the Nova-Ukraine area. This delineation made residents eligible for financial assistance to connect to a public water supply. All but four residences elected to be connected to a public water supply. Based on the results of the RI, EPA does not believe that the groundwater contamination of residential wells in the Nova-Ukraine areas is related to the Chemsol Site.

Surface Water and Sediment Investigation

The ground elevation at the Site is generally lower than the adjacent area. Surface water runoff is towards the Site during rain events. There are several wetland areas, one drainage ditch, and two streams present at the Site. During sampling for the FFS in 1991, Stream 1A was sampled and determined to be free of contamination from the Site. During the RI, two rounds of sampling were conducted in Stream 1B. Twelve sampling locations were selected. At each location, one surface water sample and two sediment samples were collected.

Surface water sampling has indicated that the Chemsol Site is contributing low levels of contamination including VOCs, pesticides and organics to Stream 1B. However, low levels of pesticides and inorganics appear to be entering the Site from off-site sources. Levels of several contaminants exceeded State Water Quality Criteria. As noted in the previous section, the area surrounding the Site contains many industrial/commercial establishments. Sediment sampling conducted in conjunction with the surface water sampling indicates the presence of VOCs, SVOCs, pesticides, PCBs and metals.

SUMMARY OF SITE RISK

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future Site conditions. The baseline risk assessment estimates the human health and ecological risk which could result from the contamination at the Site if no remedial action were taken.

Human Health Risk Assessment

The following four-step process was used to conduct the Risk Assessment:

1. *Hazard Identification*— identifies the contaminants of concern at the Site based on several factors such as toxicity, frequency of occurrence, and concentration.
2. *Exposure Assessment*— estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated groundwater) by which humans are potentially exposed.
3. *Toxicity Assessment*— determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).
4. *Risk Characterization*— summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of Site-related risks.

The baseline risk assessment began with selecting contaminants of concern which would be representative of the contamination found in various media (surface soil, subsurface soil, surface water, sediment, and groundwater) at the Site. Due to the large number of chemicals detected at the Site, only those chemicals which were thought to pose the highest risk (based on factors such as frequency of detection and concentration detected) were retained as contaminants of concern. The contaminants of concern include: pesticides, PCBs and inorganics in surface soil; 1,1,2,2-tetrachloroethane, benzo(a)pyrene, pesticides, PCBs, and inorganics in subsurface soils; VOCs in groundwater; VOCs and SVOCs in surface water; and, polyaromatic hydrocarbons, PCBs, and inorganics in sediment. Several of the contaminants of concern listed above are

known or suspected of causing cancer in animals and/or humans or of causing non-cancer health effects in the liver, kidney, respiratory tract, and the central nervous system.

An important factor which drives the risk assessment is the assumed future use of the Site. Based on discussions with the town and the fact that the Site is now zoned for residential, rather than industrial use, EPA assumed that the most probable future use of the Site would be for residential or recreational purposes. The Town expressed a preference for recreational use as the property is one of the last parcels of open land available in the Township. The current land uses at this Site have the potential to impact nearby residents (adults and children) and possible trespassers onto the Site. In the future, it is possible that potential human receptors would include residents (adults and children), Site workers (employees), and construction workers.

Pathways of exposure evaluated for the Site include: 1) sediment and soil ingestion; 2) dermal contact with soil and sediment; 3) ingestion of contaminated groundwater and surface water; 4) dermal contact with surface water; and, 5) inhalation of VOCs and particulates. Because EPA assumed a future residential/recreational land use of the Site, the list of possible human receptors identified in the exposure assessment included trespassers, residents (adults and children), Site workers (employees), and construction workers. Exposure intakes (doses) were calculated for each receptor for all pathways considered.

EPA's acceptable cancer risk range is 10^{-4} to 10^{-6} which can be interpreted to mean that an individual may have a 1 in 10,000 to 1 in 1,000,000 increased chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site. The State of New Jersey's acceptable risk standard is one in one million (10^{-6}).

EPA found that contaminants in the surface soil at the Site posed an unacceptable total cancer risk (2.2×10^{-3}) to potential future residents through ingestion and dermal contact. In addition, ingestion and inhalation (during showering) of contaminants in groundwater also posed unacceptable cancer risks (maximum of 2.4×10^{-3}) to potential future residents and Site workers. Benzene, carbon tetrachloride, vinyl chloride, chloroform, 1,1-dichloroethene, trichloroethene, 1,2-dichloroethane, and PCBs are the predominant contributors to the estimated

cancer risk.

The other receptors/exposure routes (including ingestion or direct contact with subsurface soil, and dermal contact with surface water and sediment) have estimated cancer risks within or below EPA's acceptable risk range.

To assess the overall potential for non-carcinogenic effects posed by more than one contaminant, EPA has developed a hazard index (HI). This index measures the assumed exposures to several chemicals at low concentrations, simultaneously, which could result in adverse health effects. In accordance with this approach, a hazard quotient (i.e., the ratio of the level of exposure to an acceptable level) greater than 1.0 indicates a potential of noncarcinogenic health effects. The HI is summed for all media common to a particular receptor.

With regard to non-cancer effects, based on the calculated HIs, EPA found that several potential exposure pathways could have unacceptable health effects including: ingestion of surface soil by children (HI = 6.2); ingestion of disturbed surface soil along the current effluent discharge line by children (HI = 3.7); inhalation of particulates along the current effluent discharge line by children (HI = 1.5); ingestion of contaminated groundwater by adults and children (HI = 340 for adults and 800 for children); and, ingestion of contaminated groundwater by Site workers (employees) and construction workers (HI = 120 for employees and 17 for workers). No noncancer effects were associated with subsurface soils, surface water and sediment.

In summary, the Human Health Risk Assessment concluded that exposure to surface soil and ground water, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health or welfare. In contrast, exposure to subsurface soils, sediments, and surface water was determined not to pose a significant threat to human health.

Ecological Risk Assessment

The Ecological Risk Assessment involves a qualitative and/or semi-quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals. A four-step process is utilized for assessing site-related ecological risks: *Problem Formulation* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern,

receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment* - a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment* - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization* - measurement or estimation of both current and future adverse effects.

The environmental evaluation focused on how the contaminants would affect the Site's natural resources. Natural resources include existing flora and fauna at the Site, surface water, wetlands and sensitive species or habitats. A wetlands delineation performed on-site determined that wetlands cover approximately 22 acres in Lot 1A and 3 acres in Lot 1B. Uplands in Lot 1A are wooded. No federally listed or proposed threatened or endangered flora or fauna are known to occur at or near the Site. However, white-tailed deer, woodchucks, rabbits, frogs, turtles and birds are known to inhabit the Site.

Sources of exposures to ecological receptors considered for this ecological assessment include surface soil (generally collected from 0 to 2 feet below ground surface), surface sediment (generally collected from 0-6 inches), and surface water. Data from subsurface soils (soils under pavements or from depths greater than 2 feet) were not evaluated. These depths are greater than those considered likely for potential contact with burrowing animals or roots of vegetation. Subsurface sediments (sediments from depths greater than 6 inches) also were not evaluated since fish and microinvertebrates are not likely to be exposed to contaminants at greater depths. Similarly, groundwater data were not used in this ecological assessment because it is unlikely that ecological receptors can contact contaminants associated with groundwater. Exposure may occur through: 1) ingestion of contaminated food items; 2) ingestion of contaminated surface water; 3) incidental ingestion of contaminated media (i.e. soil, sediment, or water ingested during grooming, eating, burrowing, etc.); 4) inhalation of contaminants; and 5) through adsorption upon contact with contaminated media.

Three receptor species were chosen for the Site to assess the potential adverse ecological risk of Site chemicals in the surface soil. They are the northern short-tailed shrew, the American robin, and the red-tailed hawk.

Aquatic biota and benthic invertebrates were selected as receptor species for surface water and sediment.

The chemicals of concern selected for the environmental risk assessment include: toluene, carbon tetrachloride, 1,1,1-trichloroethane, trichloroethene, chlorobenzene, xylenes, naphthalene, PCBs, pesticides, lead and manganese.

In Lot 1A and Lot 1B, the ecological risk assessment shows that the potential exists for adverse effects to shrews, robins and red-tailed hawk. While Lot 1B is a disturbed habitat, Lot 1A exists in a relatively undisturbed state. Therefore, the ecological assessment included an analysis of the potential remedial impact to Lot 1A habitat. Sediment and surface water for Lot 1A were assessed using published ecological screening values designed to be protective of benthic and water-column receptors. The results of the assessment indicate that there is a potential for risk from surface soils to small mammals and birds, a potential for risk from sediment to benthic receptors, and no significant potential for risk from surface water to water column receptors.

Two tributaries join in Lot 1A before exiting the Site to the north. Elevated levels of PCBs were detected in portions of the streams. It is not clear if the PCB concentrations in the stream sediment represent actual source areas of contamination or indicate the presence of a migration pathway for contaminants from the more heavily contaminated Lot 1B. In addition, ecological risks associated with the PCBs are minimal. Therefore, remediation of the stream is not warranted at this time. Rather, monitoring is required to determine whether remediation of Lot 1B results in a lowering of PCB levels in the streams in Lot 1A.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk based-based levels established in the risk assessment.

The following objectives were established for the Chemsol Site:

- restoring the soil at the Site to levels which would allow for residential/recreational use

(without restrictions)

- augment the existing groundwater system to contain that portion of contaminated groundwater that is unlikely to be technically practicable to fully restore and restore remaining affected groundwater to State and federal drinking water standards
- remove and treat as much contamination as possible from the fractured bedrock
- prevent human exposure to contaminated groundwater; and
- prevent human exposure to surface soils contaminated with PCB concentrations above 1 part per million (ppm) and lead concentrations above 400 ppm.
- eliminating, to the greatest extent practicable, continuing sources of contamination to the groundwater.

Soil cleanup levels for PCBs at the Site were obtained from EPA's 1990 "Guidance on Remedial Actions for Superfund Sites with PCB Contamination." For residential land use, an action level of 1 ppm is specified for PCBs. The 400 ppm lead cleanup level is based on EPA's 1994 "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities." EPA estimates that there are approximately 18,500 cubic yards of surface soil (up to a depth of 2 feet) that contain PCBs at levels above 1 ppm and/or lead at levels above 400 ppm.

The State of New Jersey has developed State-wide soil cleanup criteria for several of the contaminants found at the Chemsol Site, including several VOCs, SVOCs, lead (400 ppm) and PCBs (0.49 ppm). Based on the data collected to date, in meeting EPA's cleanup levels for PCBs and lead cited previously, EPA believes the remedy will achieve the State of New Jersey residential direct contact and impact to groundwater soil cleanup criteria. If the remedy does not achieve the State residential direct contact soil cleanup criteria of 0.49 ppm for PCB, the State will require that restrictions be placed on the property to prevent future direct contact with soils above 0.49 ppm.

Due to the complex geology and the possible presence of non-aqueous phase liquids at this Site, EPA believes that

it may not be technically practicable to fully restore some portion of the contaminated on-site groundwater to State and federal water quality standards. By law, any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards require a waiver of such standards on the basis of technical impracticability. As will be discussed in subsequent sections, if after implementation of the remedy, it proves to be technically impracticable to meet groundwater quality standards, EPA would waive such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may require a technical impracticability waiver.

SCOPE AND ROLE OF ACTION

This action is the second action taken to address the Site. The first action consisted of the interim groundwater containment system which is currently operational at the Site. This action will address on-site contaminated groundwater and soil. A third action or "operable unit" is necessary to investigate the extent of groundwater contamination outside the property boundaries.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and utilize permanent solutions and alternative treatment technologies and resource recovery alternative to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of hazardous substances.

Based on the remedial action objectives, EPA performed an initial screening process of potential alternatives that would address the soils and groundwater concerns at the Site. This Proposed Plan evaluates three Groundwater Remedial Alternatives and four Soil Remedial Alternatives for addressing the contamination associated with the Chemsol Site.

CERCLA requires that if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, EPA

must review the action no less often than every five years after initiation of the action. As such, all of the groundwater alternatives presented in this section include a five-year review and two of the four soil alternatives include a five-year review.

It should be noted that the estimated implementation times are for construction of the remedy only. The estimates do not include the time to negotiate with the Respondents, prepare design documents, or procure contracts which may be significantly longer (approximately 18 months) than the construction times shown.

The alternatives are:

SOIL

Alternative S-1: No Further Action

Estimated Capital Costs:	\$388,660
Estimated Annual O&M Costs (30 years):	\$0
Estimated Total Present Worth Value:	\$388,660
Estimated Implementation Period:	3-6 months

The "No-Action" alternative is used as a baseline for comparison of other soil alternatives. Under this alternative, EPA would take no action at the Site. However, the No-Action alternative includes, as with the other soil alternatives, a single sampling event for drummed waste and soil stockpiled at the Site, along with their transportation and off-site disposal. The drummed waste were generated from the various investigations performed at the Site and the stockpiled soils were generated from construction activities performed at the Site. Since contaminants would remain on-site, institutional controls (e.g., a deed restriction) would be placed on the property that would restrict future use of the Site. A review of the Site conditions at the end of five years would be performed to determine whether or not the contamination in the soils has spread both horizontally or vertically.

Alternative S-2A: Capping with Soil

Estimated Capital Costs:	\$1,855,850
Estimated Annual O&M Costs (30 years):	\$2,000
Estimated Total Present Worth Value:	\$1,894,000
Estimated Implementation Period:	3-6 months

This alternative includes the construction of a single layer (18 inches thick) soil cap covering 12 acres of the property which are contaminated above the soil cleanup

levels. It would also require that no intrusive activities be performed on the capped area in order to ensure its integrity. This alternative would allow for many recreational uses of the property, such as park or playground, among others. However, a restriction would have to be placed on the property to ensure that the cap is not breached. A single sampling event of drummed waste and stockpiled soil along with their transportation and off-site disposal would be performed. After completion of the remedy, a review of Site conditions every five years would be performed as required under the Superfund law.

Alternative S-3: Excavation and Off-Site Disposal

Estimated Capital Costs:	\$5,573,001
Estimated Annual O&M Costs (30 years):	\$0
Estimated Total Present Worth Value:	\$5,573,000
Estimated Implementation Period:	6-12 months

This alternative includes excavation and off-site disposal of all surface soils contaminated with PCBs and lead that are above EPA's cleanup levels. Approximately 18,500 cubic yards of soil with PCBs levels greater than 1 part per million and lead levels greater than 400 parts per million will be disposed of at a licensed and approved disposal facility. The excavated areas would be backfilled with imported clean fill from an off-site location, and covered with topsoil and seeded with grass.

The excavation and off-site disposal of the contaminated soils will allow for residential or recreational use of the Site in the future. As with Alternative S-1, this alternative includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site.

Alternative S-4A: Excavation and On-Site Low Temperature Thermal Desorption of PCB-Contaminated Soil with On-Site Solidification of Lead Contaminated Soil.

Estimated Capital Costs:	\$11,963,134
Estimated Annual O&M Costs (30 years):	\$0
Estimated Total Present Worth Value:	\$11,963,000
Estimated Implementation Period:	3-6 months

Alternative S-4B: Excavation and On-Site Low Temperature Thermal Desorption of PCB-Contaminated Soil with Off-Site Disposal of Lead Contaminated Soil.

Estimated Capital Costs:	\$12,241,639
Estimated Annual O&M Costs(30 years):	\$0

Estimated Total Present Worth Value:	\$12,242,000
Estimated Implementation Period:	6-9 months

For both Option A and B, all surface soil contaminated with PCBs above 1 part per million (18,500 cubic yards) would be excavated. The excavated soil would be treated on-site by low temperature thermal desorption (LTTD) to remove PCBs. The treated soil would then be backfilled to the excavated areas, topsoil would be placed on the treated soils and seeded. As with the other soil Alternatives, Alternative S-4(A and B) includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site.

Under Option A, the lead contaminated soil would be solidified/stabilized on-site by mixing it with Portland cement. The area on-site where this contaminated soil is placed would be protected from future intrusion. Under Option B, the lead-contaminated soil would be excavated and transported off-site for disposal at a licensed and approved RCRA disposal facility. The excavated areas would be backfilled with clean fill, and seeded.

GROUNDWATER

Alternative GW-1: No Action

Estimated Capital Costs:	\$0
Estimated Annual O&M Costs(30 years):	\$59,336
Estimated Total Present Worth Value:	\$912,000
Estimated Implementation Period:	0 months

The Superfund program requires that the "No-Action" alternative be considered as a baseline for comparison with other alternatives. Under this alternative, EPA would cease actions at the Site to treat the contaminated groundwater and to restrict the off-site migration of contaminated groundwater. However, the No-Action alternative does include long-term monitoring of on-site groundwater, to monitor the concentrations of contaminants remaining at the Site.

Alternative GW-2(A and B): Continue Existing Interim Action - Extract Groundwater from Well C-1

Option - A

Estimated Capital Costs:	\$ 45,097
Estimated Annual O&M Costs(30 years):	\$452,738
Estimated Total Present Worth Value:	\$7,000,300
Estimated Implementation Period:	0 months

Under Option-A of this alternative, the current extraction of the groundwater from well C-1 would continue. The extracted groundwater first passes through an air stripper, after which it is filtered, followed by activated carbon adsorption. The treated water is then discharged to the Middlesex County Utilities Authority (MCUA) Publicly Owned Treatment Works (POTW). The capital cost of \$45,097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property.

Option - B

Estimated Capital Costs:	\$45,097
Estimated Annual O&M Costs(30 years):	\$726,336
Estimated Total Present Worth Value:	\$11,209,000
Estimated Implementation Period:	3 months

In addition to the treatment described in Option-A, a biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. This phase is a contingency in the event that in the future, treated groundwater cannot be sent to MCUA. The biological treatment will provide additional treatment so the groundwater will achieve federal and State surface water quality standards which would allow for discharge to Stream 1A. The capital cost of \$45,097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property.

Alternative GW-5(A and B): Extract Groundwater from Additional Wells - Use Existing Treatment Processes Air Stripping/Aerobic Mixed Growth Biotreatment/Filtration/Activated Carbon Adsorption

Option - A

Estimated Capital Costs:	\$390,189
Estimated Annual O&M Costs(30 years):	\$670,892
Estimated Total Present Worth Value:	\$10,699,000
Estimated Implementation Period:	3 months

Option-A of this alternative is almost identical to Alternative GW-2A. They differ in that, in addition to well C-1, groundwater would be pumped from other on-site wells (EPA cost estimates are based on pumping five additional wells. However, the number of wells to be pumped will be determined during the remedial design.)

Pumping from these additional wells will allow for more effective on-site containment of the plume, and also allow for groundwater extraction from other contaminated areas on-site. As in Alternative GW-2A, the treated groundwater would be discharged to MCUA POTW. The capital cost of \$390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs associated with installation of additional extracting wells.

Option - B

Estimated Capital Costs:	\$390,189
Estimated Annual O&M Costs(30 years):	\$766,336
Estimated Total Present Worth Value:	\$12,169,000
Estimated Implementation Period:	3 months

A biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. Use of the biological treatment phase would allow for discharge to Stream 1A in compliance with federal and State standards. The capital cost of \$390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs associated with installation of additional extraction wells.

EVALUATION OF ALTERNATIVES

Each of the above alternatives was evaluated against specific criteria on the basis of the statutory requirements of CERCLA Section 121. A total of nine criteria are used in evaluating the alternatives. The first two criteria are threshold criteria which must be met by each alternative. The next five criteria are the primary balancing criteria upon which the analysis is based. The final two criteria are referred to as modifying criteria and are applied, following the public comment period, to evaluate state and community acceptance. The Glossary of Evaluation Criteria describes the nine criteria used in evaluating remedial alternatives.

A comparative analysis of these alternatives based

upon these evaluation criteria is presented below.

Overall Protection of Human Health and the Environment

Soil

Alternative S-1, No Action, would not be protective of human health and the environment because the Site would remain in its current condition. The soils would continue to pose a threat to potential future residents and trespassers. Therefore, Alternative S-1 has been eliminated from consideration and will not be discussed further.

Alternative S-2A relies on containment and institutional controls to provide protection over time. Deed restrictions would have to be enforced to ensure that the cap is not breached in the future in order for this alternative to be protective.

Upon completion of Alternative S-3 and Alternative S-4(A and B), all risks to human health and the environment from organic and inorganic contaminants would be eliminated through off-site removal or treatment of contaminants in the surface soils to protective levels.

Groundwater

Alternative GW-1, No Action, would not be protective of human health and the environment because the groundwater would continue to migrate off-site continuing to pose a potential threat to users. Therefore, Alternative GW-1 has been eliminated from consideration and will not be discussed further.

Alternatives GW-2 (A and B) and GW-5 (A and B) would be protective of human health by controlling the migration of contaminated groundwater through pumping and by removing contaminants through treatment of pumped groundwater. GW-5 (A and B) captures and removes more contamination than GW-2 (A and B), and therefore

GLOSSARY OF EVALUATION CRITERIA

Threshold Criteria

Overall Protection of Human Health and the Environment: This criterion addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs: This criterion addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and requirements or provide grounds for a waiver.

Primary Balancing Criteria

Long-term Effectiveness: This criterion refers to the ability of a remedy to maintain protection of human health and the environment, once cleanup goals have been met.

Reduction of Toxicity, Mobility or Volume through Treatment: This criterion refers to the anticipated performance of the treatment technologies a remedy may employ.

Short-term Effectiveness: This criterion considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Implementability: This criterion examines the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Cost: This criterion includes capital and operation and maintenance costs.

Modifying Criteria

State Acceptance: This criterion indicates whether, based on its review of the RI/FS report and Proposed Plan, the state concurs, opposes, or has no comment on the preferred alternative.

Community Acceptance: This criterion will be addressed in the Record of Decision following a review of the public comments received on the RI/FS report and the Proposed Plan.

best meets this criterion.

Compliance with ARARs

Actions taken at any Superfund site must meet all applicable or relevant and appropriate requirements of federal and state law or provide grounds for invoking a waiver of these requirements. There are several types of ARARs: action specific, chemical-specific, and location specific. Chemical-specific ARARs are usually numerical values which establish the amount or concentrations of a chemical that may be found in, or discharged to, the ambient environment. Location-specific requirements are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in a special location. Action-specific ARARs are technology or activity-specific requirements or limitations related to various activities.

Soil

There are no federal or State promulgated soil cleanup standards. Alternative S-2A does not meet State soil cleanup criteria which, while not legally applicable, were considered by EPA as cleanup levels for the Site. If the State soil criteria were not met, institutional controls would be required by the State.

In addition, because a portion of the Site is classified as wetlands, all alternatives (soil and/or groundwater) would need to comply with Section 404 of the Clean Water Act and federal Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Any actions which disturb or impact wetlands would additionally require development of a wetlands mitigation plan.

If implemented, Alternatives S-3 and S-4(A and B) would meet chemical-specific, location-specific and action-specific Federal and State ARARs for the contamination in the soils. The major ARARs for

Alternative S-3 are Federal and State Resource Conservation and Recovery Act (RCRA) requirements which control the transportation and disposal of hazardous waste. For example, the soil excavated under Alternative S-3 would be disposed at a facility which is licensed under RCRA to accept hazardous waste. Alternatives S-4(A and B) would involve the use of an on-site treatment technology which would be subject to RCRA treatment regulations and Clean Air Act requirements regarding emissions from the treatment system. Air emissions will require air permit equivalences from the State of New Jersey.

Groundwater

Alternatives GW-2 (A and B) and GW-5(A and B) would meet the chemical-specific ARARs for the treated water before discharge. These include New Jersey Pollutant Discharge Elimination System requirements for discharges to surface water. In addition, air emissions from the treatment plant would need to comply with Federal and State emissions standards. Alternatives GW-2(A and B) and GW-5(A and B) produce a filter cake that might need to be disposed of as a RCRA hazardous waste. In accordance with State regulations, a classification exception area (CEA) will have to be established once the extent of contamination associated with the Chemsol Site has been determined.

Alternative GW-5(A and B) is more likely to achieve State and federal water quality standards in the aquifers than is GW-2. It is possible that it will be technically impracticable to restore all portions of the aquifers to meet State and federal standards. Any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards require a waiver of such standards on the basis of technical impracticability. If after implementation of the remedy, it proves to be technically impracticable to meet water quality standards, EPA would waive such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may

require a technical impracticability waiver.

Long-Term Effectiveness and Permanence

Soil

Alternatives S-4(A and B) provide the highest degree of long-term effectiveness and permanence since the waste would be treated to permanently remove organic contaminants. Alternative 3 provides a high degree of long-term effectiveness by removing waste from the Site but does not provide a high degree of permanence since waste would not be destroyed but only contained off-site.

Under Alternative S-2A, contaminated soils would remain on-site and, therefore, this remedy would provide the least amount of long-term effectiveness and permanence. In addition, institutional controls would need to be employed and enforced in order to ensure the effectiveness.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) provide varying amounts of containment of the contaminated groundwater. Additional off-site investigations to determine the extent of groundwater contamination are necessary to ensure that risks to neighboring communities are minimized. Alternatives GW-5 (A and B) provide a higher degree of long-term effectiveness than Alternative GW-2 (A and B) by increasing the amount of groundwater captured on-site and removing more contaminants from the extracted groundwater through treatment.

Short-Term Effectiveness

Soil

Alternatives S-2A, S-3, and S-4(A and B) do involve construction activities that would pose a low level risk of exposure to soils by ingestion, direct contact and inhalation to Site workers; however this risk can be managed by appropriate health and safety measures. All of the alternatives can be

implemented relatively quickly, in less than a year following completion of design.

Alternative S-3 involves a significant increase in dust, vapor, and noise generation during soil excavation. These would be minimized through the use of measures which would be undertaken to ensure that all activities are performed in such a way that vapors, dust, and other materials are not released to the surrounding community during excavation. In addition, Alternative S-3 includes off-site transportation of the excavated soils. This will increase truck traffic and noise in the community during the period when soil is being transported off-site. EPA will design transportation flow patterns to minimize traffic impacts on the community. EPA will also explore the use of constructing a road from the Site which will bypass residential areas.

Under Alternative S-4(A and B), a thermal desorber would be placed on-site, causing increases in noise and emissions from the unit. To minimize the risk from inhalation of vapors from the thermal desorber which is required, a secondary chamber would be utilized that would oxidize all organics compounds released from the LTTD process to carbon dioxide, water and hydrochloric acid.

Groundwater

All the groundwater alternatives provide short-term effectiveness in protecting the Site workers and neighboring communities from the risks due to ingestion and inhalation of VOCs. Alternatives GW-2(A and B) and GW-5(A and B) would pose a low level risk to Site workers during construction; however, this risk can be managed by the use of appropriate health and safety measures. Alternative GW-2 is a continuation of the existing system and is running now. Alternatives GW-5 (A and B) can be implemented very quickly (in approximately 3 months) since they are simply an addition to the current system.

Reduction of Toxicity, Mobility or Volume Through Treatment

Soil

Alternatives S-4(A and B) provide for physical removal of the contaminated material and the maximum reduction in toxicity and mobility through treatment. Alternative S-2A and Alternative S-3 do not include the use of treatment to reduce the toxicity, mobility or volume of contaminated soil. For Alternative S-2A, reduction in the mobility of the contamination would be achieved through the use of containment. For Alternative S-3, reduction in toxicity, mobility and volume would be achieved through excavation and off-site disposal.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) reduce the toxicity and volume of contamination from the extracted groundwater. However, Alternative GW-5(A and B) would operate at twice the pumping rate of Alternative GW-2(A and B). The mobility of the contaminants is completely controlled by the pump-and-treat alternatives to the extent that the groundwater is within the capture zone of the wells. Greater reduction of volume and toxicity of contaminated groundwater is achieved by GW-5 than GW-2. Alternative GW-5 also results in greater capture and containment of contaminated groundwater.

Implementability

Soil

All of the services and materials needed to implement the soil alternatives are readily available commercially. Each alternative utilizes standard technologies for excavation, capping and transportation of soils. However, due to the high demand for thermal desorption units, there may be a delay in implementing Alternative S-4 (A and B). All the alternatives are technically feasible but Alternatives S-4(A and B) require a treatability study to obtain design parameters for the full-scale system. Alternatives S-4(A and B) have complex administrative issues because of the quantity of

equipment that needs to be set up at the Site and the need to provide substantive compliance with State air emissions permit requirements. Alternative S-3 is easily implementable using standard excavation technology. If possible, a temporary access road that would provide more direct and access from the Site to nearby highways, would be built, in order to minimize the number of trucks traveling through the community.

Groundwater

All of the services and materials needed to implement the groundwater alternatives are readily available commercially. All the alternatives are technically feasible but Alternatives GW-2(A and B) and GW-5(A and B) require skilled operators to successfully implement the remedy. The alternatives are also feasible from an administrative standpoint. The required activities for the pump-and-treat would occur on Chemsol property. The treatment plant for the interim remedy has already been built and has been in operation for the last two years with discharge to the MCUA POTW. The effluent line for the discharge to Stream 1A has also been installed even though it is not currently being used.

All the services needed to implement the alternatives already exist. The pump-and-treat alternatives require the most services since they require operation of the treatment plant and disposal of filtered waste from the plant.

Costs

The capital, annual operation and maintenance, and present worth costs are presented below for each alternative. Present worth costs for all the alternatives were calculated assuming a 5% interest rate and a 30-year operation and maintenance period.

Soil

Capital costs for Alternative S-1 are estimated to be \$338,660 which includes costs for a single sampling event of drummed waste and stockpiled soils along with transporting and off-site disposal of the drummed waste and the stockpiled soil. There would be no operation and maintenance costs so that the total present worth is estimated to be \$338,660.

Capital costs for Alternative S-2A are estimated to be \$1,855,850. This includes the costs of the sampling and

off-site disposal described for Alternative S-1 plus the costs of constructing and seeding the soil cap. Annual operation and maintenance costs are estimated to be \$2,000. The total present worth is estimated to be \$1,894,000.

Capital costs for Alternative S-3 are estimated to be \$5,573,000. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and disposing of the contaminated soils off-site. There are no annual operation and maintenance costs so that the total present worth is estimated to be \$5,573,000.

Capital costs for Alternative S-4A are estimated to be \$11,963,000. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site. There are no annual operation and maintenance costs since the treatment would be accomplished in less than a year so that the total present worth is estimated to be \$11,963,000.

Capital costs for Alternative S-4B are estimated to be \$12,241,000. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site and disposing the lead-contaminated soils off-site. There are no annual operation and maintenance costs since the work would be accomplished in less than a year so that the total present worth is estimated to be \$12,241,000.

Groundwater

In the case of all groundwater alternatives, the costs presented below are in addition to those already incurred to install and operate the existing interim extraction and treatment system at the Site.

Alternative GW-1 does not have any capital cost. The annual operation and maintenance costs are estimated to be \$59,336 and include costs for monitoring the groundwater. The total present worth cost is estimated to be \$912,000.

Capital costs for Alternative GW-2A are estimated to be \$45,097. These costs include costs associated with installation of underground piping from well C-1 to the treatment plant. The annual operation and maintenance costs are estimated to be \$452,738. The total present

worth is estimated to be \$7,000,300.

Capital costs for Alternative GW-2B are estimated to be \$45,097 and include costs associated with installation of underground piping from well C-1 to the treatment plant. Annual operation and maintenance costs are estimated to be \$726,336. The total present worth is estimated to be \$11,209,000.

Capital costs for Alternative GW-5A are estimated to be \$390,189 and include costs associated with installation of underground piping from well C-1 to the treatment plant and costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be \$670,892. The total present worth is estimated to be \$10,699,000.

Capital costs for Alternative GW-5B are estimated to be \$390,189 and include costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be \$766,336. The total present worth is estimated to be \$12,169,000.

State Acceptance

The State of New Jersey cannot concur on the preferred remedy unless its soil direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria.

Community Acceptance

Community acceptance of the preferred alternative will be assessed in the Record of Decision following review of public comments received on the RI/FS report and the Proposed Plan.

PREFERRED ALTERNATIVE

Based upon an evaluation of the various alternatives, EPA recommends Alternative S-3 as the preferred alternative for the cleanup of the soil at the Site and Alternative GW-5 as the preferred alternative for the cleanup of the groundwater at the Site.

Soil

The preferred soil alternative, Alternative S-3, provides for excavation and off-site disposal of approximately 18,500 cubic yards of contaminated soils, followed by

backfilling with clean fill and topsoil and seeding. The preferred remedy will allow for future unrestricted use of the Site. In addition, sediment and surface water monitoring would be conducted to determine whether remediation of Lot 1B results in a lowering of PCB levels in the streams in Lot 1A.

The cost for the soil excavation is estimated at approximately \$5,600,000 with no annual operation and maintenance. EPA prefers Alternative S-3 over Alternative S-4(A and B) because it would provide an equivalent level of protection at less than half the cost of Alternative 4(A and B) which is estimated at \$11,963,134 - \$12,242,000. The preferred alternative will also meet all ARARs.

Off-site disposal provides a higher degree of permanence and long-term effectiveness than on-site containment. While treatment would provide a higher degree of permanence than off-site disposal, the costs of treatment are high in comparison to those for off-site disposal. While there are short-term impacts associated with excavation and transportation of contaminated soil, these can be minimized through proper planning. For instance, during design, EPA would explore the feasibility of constructing a road from the Site which would minimize the amount of truck traffic through the surrounding neighborhood.

Groundwater

The preferred groundwater remediation alternative, Alternative GW-5, includes installation of additional extraction wells to contain the contaminated groundwater on the Site. The selection and number of additional extraction well to be pumped will be determined during the remedial design. The preferred alternative is similar to the existing interim groundwater remedy except that additional extraction wells would be pumped. The existing treatment facility would not need to be changed.

Based on groundwater flow modeling, the preferred alternative provides protection by capturing all contaminated groundwater from the upper water bearing zone (including some off-site areas) and most of the contamination within the middle and deep water bearing zones. The preferred remedy will extract groundwater at more than twice the current rate and provide greater protection by capturing, containing and treating the contaminated groundwater. The discharge from the treatment plant would continue to be sent to

the MCUA POTW. However, if the discharge cannot be sent to MCUA, the biological treatment portion of the plant will be brought online. The biological treatment step, will allow for direct discharge to Stream 1A.

The present worth cost of the preferred groundwater alternative is \$10,700,000 (assuming discharge to MCUA) which is \$3,700,000 more than the present worth cost of the current interim remedy. These higher costs result from a higher capital cost due to the additional extraction wells and the higher operation and maintenance costs resulting from the increased pumping rate and the additional wells to be maintained. In the event the biological unit is brought on line, the total present worth for the preferred remedy will increase by \$1,500,000 from the current interim remedy.

These cost estimates are based on an assumption that the systems will operate for 30 years. However, it is possible that the system will operate for longer or shorter periods depending on the results of future monitoring. The groundwater system would be shut-down if ARARs are achieved or if monitoring results show that further operation of the system will not reduce the concentrations in groundwater and that contaminated groundwater will not migrate off-site at levels which are above health-based limits for the nearest receptors. EPA will undertake additional groundwater investigations to determine if contaminated groundwater is leaving the property boundaries.

The preferred alternatives will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. EPA believes that the preferred alternatives will be protective of human health and the environment, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

NEXT STEPS

After EPA has presented the preferred alternative at the public meeting and has received any comments and questions during the public comment period, EPA will summarize the comments and provide its responses in a document called the "Responsiveness Summary." The Responsiveness Summary will be appended to the Record of Decision, which will describe the final alternative selected by EPA and provide EPA's rationale for that selection.



MAILING LIST ADDITIONS



If you know of someone who is not receiving information and would like to be placed on the mailing list for the Chemsol Site, call Ms. Pat Seppi at (212) 637-3679, e-mail her at seppi.pat@epamail.epa.gov, or fill out and mail this form to:

*Ms. Pat Seppi
Community Relations Coordinator
U.S. Environmental Protection Agency
290 Broadway, 26th Floor
New York, NY 10007-1866*

Name _____

Address _____

Telephone _____

Affiliation _____

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - D

Public Notice
Printed in The Home News and Tribune
on
August 11, 1997

100538

Affidavit of Publication - 7-8-0390-NAPA -

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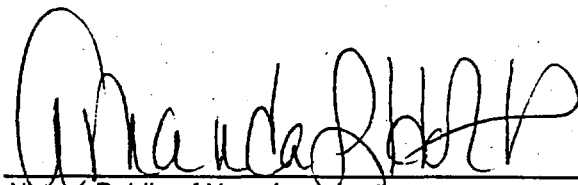
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of the **The Home News & Tribune**, a newspaper printed in Freehold and published in NEPTUNE, in said County and State, who being duly sworn, depose and saith that the advertisement of which the annexed is a true copy, has been published in the said newspaper

(1) ONE times, once in each issue, as follows

AUGUST 11TH

A.D., 1997


Notary Public of New Jersey

Margaret Parlman
Sworn and subscribed before me this
29th day of August A.D., 1997

AMANDA L. HOLT
2038453

NOTARY PUBLIC OF NEW JERSEY
My Commission Expires December 18, 1997



The United States Environmental Protection Agency Announces a 30-day Public Comment Period and Public Meeting for the Proposed Plan for Final Cleanup at the Chemsol, Inc. Superfund Site in Piscataway, New Jersey

Public Comment Period
August 11, 1997 thru September 10, 1997

The Proposed Plan outlines EPA's Preferred Alternative for final cleanup of contaminated soil and groundwater at the site. The Preferred Alternative for soil includes excavation and off-site disposal of contaminated soil. The Preferred Alternative for groundwater includes extracting groundwater from additional wells and using existing treatment processes. The Proposed Plan, along with the Remedial Investigation and Feasibility Study Reports, will be available for review during normal business hours at the following locations:

Kennedy Library
500 Hoes Lane
Piscataway, NJ

U.S. EPA Superfund Docket Center
290 Broadway, Floor 18
New York, NY

Public Meeting
Wednesday, August 27, 1997
7:00 p.m.
Municipal Building
455 Hoes Lane
Piscataway, New Jersey

Submit comments during the meeting or in writing (on or before 9/10/97) to:

Nigel Robinson, Project Manager
U.S. EPA Region 2
290 Broadway, Floor 19
New York, NY 10007

For more information contact Pat Seppi
U.S. EPA Community Involvement
1-800-346-5009

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